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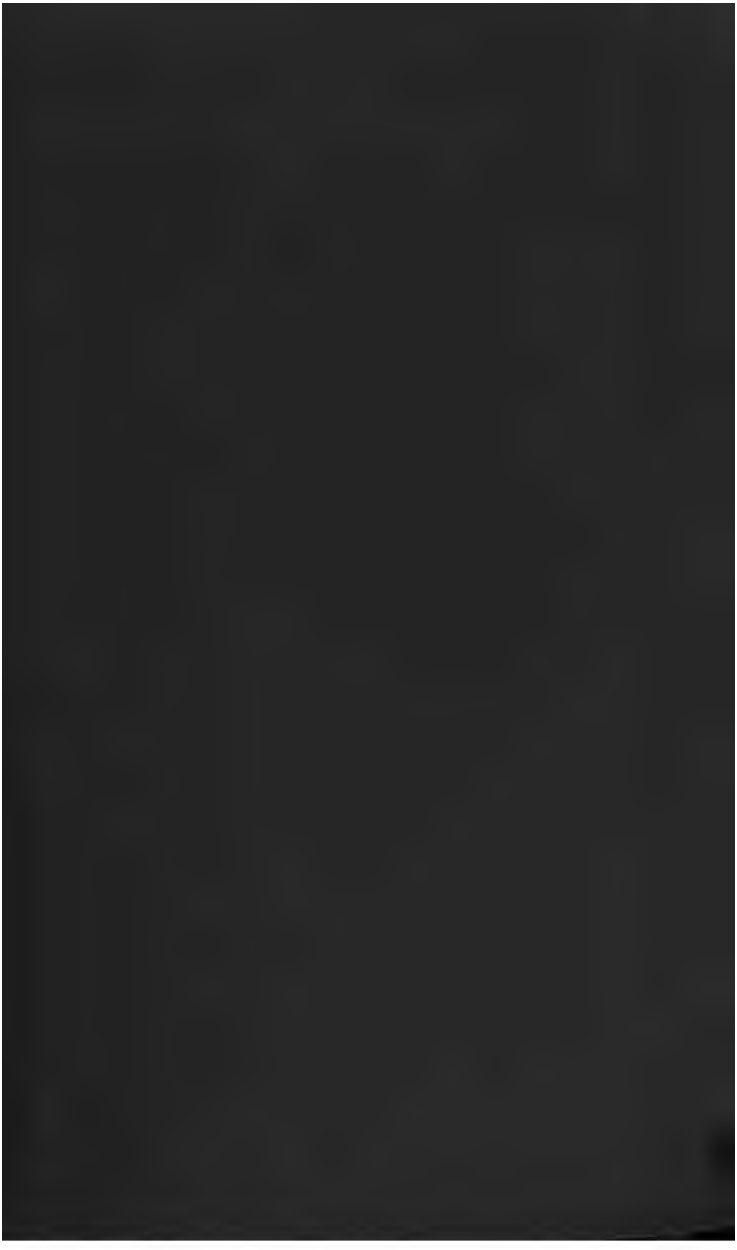

MARVELS AND MYSTERIES

OF

INSTINCT;

OR,

CURIOSITIES OF ANIMAL LIFE.

BY

G. GARRATT.

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PREFACE.

THE subject of this volume was delivered in the form of a lecture, and the interest which its Marvels and Mysteries awoke subsequently induced the Author to fill up at his leisure the sketch he had made. The principal object has been to select for consideration those topics which would instruct and entertain the general reader. Simplicity of form has been studied in the treatment of every topic, that the whole might be understood by the humblest capacity.

The Table of Contents indicates the general plan, and the subjects from which the Marvels and Mysteries have been taken, are treated in the following order: The Divine Method — Nervous Systems — Instinct — Instinct in Man — in Apes — in Mammals — in Birds — Theory of Sensation — Animal Intelligence — Instinct in Insects — Reason and Instinct compared.

If the Author's labours should prove instrumental in leading but one mind to the study of God's wonderful Creation, he would feel that his chief hope had not been altogether disappointed.

Burcott Cottage,
April, 1856.

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MARVELS AND MYSTERIES

OF

INSTINCT.

CHAPTER I.

The Creator.—The Creation.—Man, the Chief.—Adam's Creation a Miracle.

If with the dim and flickering light of the Greek philosophy, which prevailed more than two thousand two hundred years ago, Aristotle, the preceptor of Alexander the Great, could declare that to give a treatise on the world, and nothing upon its Author, would be impious, with how much greater force must the truth of the observation be felt, when supported by the flood of glorious light and knowledge which the nineteenth century is pouring on the human intellect?

The pious disposition of Sir Isaac Newton prompted him to make a voluntary choice of the example of his great prototype, and he cheerfully acted upon the admonition of the ancient sage. His strong sagacity, as well as his religious instinct, directed him to the Supreme Being, as the sovereign ruler of the universe. His reason was fully convinced that the attempt to base its government upon anything else was not only difficult, but that it led also to the most extravagant absurdities. Nature speaks to her pupils with ten thousand voices, all of which are vocal with the praise of the Most High; and point to Him as the source of their

emanation. She teaches lessons of the highest wisdom, and furnishes illustrations of the purest benevolence. She utters a rebuke to man's folly, and guides him in the paths of rectitude. Her mysteries and her marvels fill the contemplative mind with wonder; the good meditate upon the latter with delight, and in faith anticipate the revelation of the former. Such persons are not wise above what is written, nor are they faithless as to that which is not revealed. The wise philosopher puts one hand upon the works of God, and the other upon His word; then, to him, the solution of Nature's mysteries becomes only a question of time; and since God is the alpha and the omega of everything, let Him be the first and the last of all that man undertakes.

The study of the creation cannot possibly be prosecuted with either pleasure or profit to him who does not refer the ultimate cause of all causes and effects to the Creator. Without a reference to him, the voyager will ever find himself upon a rude and treacherous sea, with neither chart nor compass to guide him to his destiny. The chances are, that he will be tossed by the winds and waves from one shoal to another, till he become eventually split upon a rock; and then feel to his bitter cost that he is nothing more than a floating wreck upon the bosom of the ocean. To change the figure, he has no foundation upon which to rear a superstructure. Man may as well attempt to build his house upon the ever-shifting sands, as to seek to understand the book of creation, without a settled faith in the Divine Being, as the supreme lawgiver to the whole universe. Nature's works and Nature's God, must be studied together, or everything will for ever remain shrouded in dismal gloom. In every variety of form may be found the mysteries of the Infinite, and, although innumerable, all resolve themselves into the one great mysterious "I Am."

Let the foregoing be sufficient to introduce us a little nearer to our subject, and as it is one which involves many curious manifestations of some mysterious faculty, we beg our readers to be prepared to encounter the difficulties of the dark and secret things, by referring

them to the All-wise Being for the true explanation, and then they, though amazed, will not be bewildered by inexplicable operations, and such that are incomprehensible to their understandings. The animal kingdom will furnish many such, and manifestations of faculties and powers that cannot be comprehended by man's mind, while confined by the limitations of the present. The intellect of man is no doubt given to him for the purpose of exploring the nature and extent of God's handy works, so far, at least, as its powers are able to conduct him; and it is most assuredly his duty as well as his privilege, to follow the pursuit as far as any light will guide him; but there he must stop. Here let him remain satisfied, and rest his faith upon the promise that the now unknown shall be revealed hereafter, for "the secret things belong unto the Lord our God."

All creation is full of marvellous variety, and man, who is the lord of all, is a wonder unto himself. Though possessing many things in common with the animals, he is yet very different from it; and, as we shall endeavour to show, infinitely superior to any other form of existence. The whole earth seems to have been created for him, and all the forms of its life brought into being either for his use or for his instruction. As all things are full of interest to him, so should his life be full of his Maker's praise. Between him and the lowest form of matter, or the elementary principles, there are two grades of living things, which elaborate from earth and air the means of his sustenance. The vegetable prepares him his farinaceous food, while the animal converts the vegetable into his meat. Thus the operations of both are put into requisition to supply him with all those necessaries, which fitly nourish and support his constitution. But these things are accomplished by a regular succession of means, and such as display that the presence of a wonderful contriving power is existing somewhere. Every part is so nicely adapted to another part, and the precise wants of one thing so exactly supplied by another thing, as well as the manner in which they are often sought and found, combine to excite the curiosity and draw forth the admiration of the intelligent observer.

But though many things present a marvel and a mystery, everything, speaking according to the natural course of events, is not a miracle. If living beings originated, as they most certainly did, in a miracle, they are not sustained and perpetuated in that way. Such is not the mode of the Divine procedure.

The first man was not born. In an instant, we may suppose, he came forth direct from the hand of his Maker. He knew neither infancy nor childhood. At one and the same moment he opened his eyes and saw; his heart beat, and the blood circulated in his veins. It was by no gradual accumulation of osseous matter that formed and matured his bones; nor was it by nutrition that flesh grew upon them, giving to his whole frame a symmetrical and pleasing form. But he stood forth at once a perfect man, and every organ, with all its complexity, delicacy, and repletion of design, was wonderfully and nicely adjusted in the whole, and that purely independent of either means or time.

"The hand that modelled the dust into the abode of a sentient being, touched it with perfection; and no better type of form or finish will be required by the spirit of man through the dispensations of earth, be they dark or be they glorious, than a body like that in which the first man bowed in worship, or walked erect in fellowship with his God. The body itself mirrors its Maker."

Adam stood, as he was intended to stand, the noblest creature of all creation. The world has not seen his beauty since. His face, too, what an illustration of fine physiognomy! Who among men has ever seen its like? No internal evil had traced lines of external deformity down his calm symmetrical features. It was an index, not of vice within, but of the purest and heavenly-like virtue. He was pure, too, in every part of his structure from the crown of his head to the soles of his feet.

Such was the peculiarity of his physical constitution, and it was also equally characteristic of his mental one. The brain of his head was not destined to laborious exercise in order to acquire the first principles of knowledge. As appeared his body, so appeared the knowledge and the reasoning faculties of his mind, both ready for

mutual action; and at his command, too, was the language, of which he could make immediate use. (This particular has had a resemblance in the day of Pentecost.) We cannot suppose that Adam began to learn at his A, B, C. Of such infant toil he knew nothing, and if ever he was a child at all, it must have been at those times only when it is said that the man is once a man and twice a child, and in that sense merely.

What a curious sensation must that have been which Adam experienced when he took his first gaze upon all those natural beauties which surrounded him in the Paradisaical garden, and when he found he stood unconnected with any previous matter, and could remember no past.

These were miracles. But the race of Adam were to be brought to maturity under very different circumstances, and by a succession of certain means and slow processes. The growth of their physical constitutions requires the duration of a long series of years, and the incessant ministering of the proper agencies; while to furnish and develop their mental faculties, require the application of a large amount of teaching, of precept, and of example, through years of much toil. And so wonderful in capacity and elasticity is the human intellect, that after all that can be done and that as long as man can live, the mind is neither filled nor brought to perfection. Yea, the more it receives, the more it will hold. What an extraordinary volume it is! How compact its pages, how closely may they be printed! It is ever going on to perfection — ever learning, and yet never able to come to a knowledge of the truth. Indeed, well may it be asked, where and when is this surprising and incomprehensible faculty of man to become perfect and full? In eternity? If so, when? and what will ever satisfy it?

This is the power peculiar to man; and this it is which distinguishes him from the brute. The comparison, however, will be instituted subsequent to the facts which we shall endeavour to bring forward as illustrations of the power peculiar to animals.

Before proceeding to the task more immediately appointed to us, we propose giving just an outline of the nervous systems in man and animals, and of the functions

of the human brain. This will be found a necessary preliminary in order the better to understand the nature of some of the questions that will arise out of our subject. There are authors who ascribe several of the phenomena of Instinct to sensation, and sensation has its seat in the nervous system; but, according to our view of it, the facts will in no way support such a theory. Besides this, however, there are other much more important reasons why some little knowledge of the nervous system is requisite to every one who is disposed to pry into the marvellous workings of Instinct.

CHAP. II.

The Human Brain. — Man's Face. — Bones of his Cranium a Marvel. — Cromwell's Brain. — The Spine a great Contrivance. — The Spinal Chord. — The Nerves. — Their curious Properties. — How communicate with the Brain. — Experiment on them.

This organ, the uppermost in the structure, is contained in the cranium. It is evidently the seat of that faculty in man which distinguishes him from the brute, and elevates him to superior dignity. In him it is larger and heavier in proportion than those of animals; and consequently its functions work with a corresponding degree of power. In addition to the greater mass of its matter, something also may be said as to the posture of the head that contains it. It is differently articulated to the neck to what those of animals are. The head in man rests upon the first vertebra of the neck by means of a sort of hinge-joint, which allows the play of the backward and forward motions, as far, at least, as the ligaments will permit. This being accomplished the rotatory motion was to be provided for, and that is done by a kind of *tenon* and mortise, which connects the uppermost bone or vertebra and the next one underneath it. The contrivance is double, and very remarkable; for it provides for both motions without the one interfering with the other, and that in a part where the slightest injury might prove of fatal consequence. The uppermost joint is called the atlas. Through an aperture

in this bone proceeds the spinal chord, and so on through the rest of the vertebræ quite down the back. The bone at the top of the vertebræ, connecting the atlas, is called the occipital bone.

When a man throws himself upon all fours, he has the greatest difficulty in raising his head to look forwards; nor can this position be acquired by habit, so as to be natural, for there is a protuberance on the occipital bone to prevent it. On the occipital bone of animals there is no protuberance of the kind, and in most of them the great hole of that bone is situated at the back part of the head, and the plane of its aperture is vertical, while that in the occiput of man is almost horizontal; indeed, the head of the animal is not balanced on the spine, but is supported by muscles and ligaments, which are very strong in those quadrupeds that have heads of great weight. The design is evident: man was to walk in the dignity of the erect posture, the animal upon all fours. The one was to look to the earth, the other to the heavens.

The human face, under the front of the cranium, is in a vertical line, and the jaws, compared with those of most animals, are short, and extend but very little in front of the forehead. The animal face is placed generally in advance of the cranium, rather than under it. The inferior tribes represent a greater obliquity in the facial angle, and stupidity is associated with the elongation of the snout. Hence Solomon's proverb — "As a jewel of gold in a swine's snout, so is a fair woman which is without discretion."

As we recede from man, making the descent of the animal kingdom, the cranium is seen to diminish until at length it becomes lost altogether. This test is very greatly in favour of the superiority of man. His noble structure, moreover; his erect and commanding attitude; his majestic deportment; his firm gait, though touching the earth only with one extremity; and the display of a divine image in his face; all combine to declare, as with the voice of acclamation, that he is designed to be the lord in creation.

Great and peculiar, too, has been the care with which the bones of the skull have been shaped and

put together. The different parts of the bony fabric are wedged and locked into one another on the principle which constructs a bridge in the form of an arch, with key-stone and buttresses. So that if pressure be applied to the arch, the temple bones on each side will act like the buttresses of a bridge; and the two side bones, called the parietal bones, of the convex surface, rest upon the edges of the temple bones, in a manner that it is not possible for any amount of force to slide them off. This completely effectual provision is made by the parietal bones being levelled off at an acute angle, so as to be overlapped by the edges of the temple bones. Then again the temple bones are locked into the spheroidal bone, which is the central piece at the base of the skull. The same may be said also of the frontal bone, or os frontis, which is locked in with the others, so as to prevent any starting outwards by the force of a sudden blow. Thus, the solid framework is unyielding in all its parts. It is a strong fortress, constructed for the defence of an important province. The form of its vault or dome effectually resists all external pressure; and the soft, delicate, and mysterious organ within is most admirably protected from all injury coming from without. This was the end to be sought; and the contrivance is complete.

There is another feature in the architecture of the skull-cap we cannot pass over without some notice, since it seems to display more wonderfully still the provident design of the Great Architect. It is the composition of the bones themselves. An ordinary bone here would be liable to fracture, and would also allow the transmission of vibrations from concussions to the brain. Two things then were to be provided against; and this is effected by the bone being composed of two plates instead of one. The outer plate, instead of being brittle and of easy fracture, like bones in general, is fibrous and tough, and not therefore easily broken; the inner plate is more brittle in its nature, therefore harder and more powerful to resist any direct pressure. Not only so, but there is another thing yet, which deserves particular attention; and that is, the *cancellated structure*, which is a thick layer of spongy bony fibres, intervening between the two

strata of bones, and there acting the part of a cushion, arresting the progress of external vibrations, and at the same time preventing the fracture of the internal plate. It seems hardly possible that any sound intellect, which is able to comprehend this elaborate contrivance, can look into it without admiring the exquisite beauty of the adaptation of the means to the end to be answered. There are, too, others of considerable beauty and importance that might be mentioned, such as the greater thickness of those parts of the bones of the skull that are more particularly exposed to blows, as well as the *sutures*, or joinings of the bones, which are so contrived as to stop the transmission of vibrations extending to any distance round the cranium; but the bare allusion to them must be sufficient. The strength of the castle betokens an important inmate, the character of which we shall now endeavour to investigate.

The cavities of the cranium are filled with a large mass of a pulpy substance, called the brain. The nervous system includes the brain, and all its distributions, such as the spinal chord, and the nerves it sends to every part of the body. The brain itself is divided into the brain proper, or the *cerebrum*, and the small brain, or the *cerebellum*. The former, which is considered the seat of the intellectual faculties, is placed in the front part of the head; while the latter, supposed to be the source of those propensities which are common to man and animals, is situated in the lower and back part of the head. Surrounding the brain is a sort of double membrane; the outer one, being hard, is termed the *dura mater;* and the inner one, which is thin and soft, is called the *pia mater*. At the head of the spinal chord is a kind of bulb, denominated the *medulla oblongata;* and so situated at the central part of the base, as to connect the cerebrum with the cerebellum.

The average weight of the human brain in adults, when washed of its blood, is about three pounds; that is, taking all the three parts together, the cerebrum, the cerebellum, and the spinal chord. The average of the first, or brain proper, is about two pounds; while that of the cerebellum is not more than about five or six ounces, being thus only about one seventh of the whole. It is said

that Cromwell's brain was most prodigious; for, having been put in the scales, it turned a weight of six pounds and a quarter. One can easily believe that it was unusually large,—far exceeding those of men in general; but it is difficult to believe it was the monster that such a weight would make it. Cuvier's brain, however, is well known to have been extraordinarily large, and of an immoderate mass and weight.

The spine, or back-bone, is an assemblage of bones, that form a piece of workmanship of a very wonderful and peculiar construction. It serves so many purposes, that their number and contrariety would have puzzled the art of the master mechanic to have embodied them all in one piece of mechanism. He must have solved the difficulty of that problem, which would have included the following conditions:—how to construct an apparatus, so as to be capable of fulfilling the most inconsistent and opposite functions; an instrument that would give support to the trunk, and thus act the part of a great beam to the whole fabric, at the same time, to furnish a basis of support to all the other bones of the skeleton; the body was to be held erect, it therefore must be *firm*—yet it must be *flexible*, for a curving motion, both laterally and longitudinally, was required; a canal or tube was also wanted, it must therefore be hollow; the canal moreover, demanded numerous outlets all down both its sides; and yet the fluid to traverse it was to be so delicate and tender, that if the apparatus would not at the same time protect it from even the slightest injury or pressure, the whole contrivance would be just good for nothing. Now, how seemingly incompatible are all these different functions, quite from first to last! And had such a task been set, the probability is, that the mechanic would not have racked his thoughts with a problem, the solution of which would have appeared so utterly hopeless. No wonder either, when the operations of such contradictory offices are taken into consideration. But it really has been solved, and man's spine offers the illustration.

"Bespeak," says Paley, "of a workman a piece of mechanism which shall comprise all these purposes, and let him set about to contrive it; let him feel the difficulty

of accomplishing the task, before he be told how the same thing is effected in the animal frame. Nothing will enable him to judge so well of the wisdom which has been employed; nothing will dispose him to think of it so truly."

The Architect of the human frame has most admirably exemplified it in the following manner. The sub-division of the spine into a great number of bones gives the flexibility that allows a considerable curve to be formed without any sufficient relative displacement of the several vertebræ that would interfere with the passage of the spinal chord, or even to exert the least pressure upon it, which would be of fatal consequence. Though the bend in the whole column may be very considerable, it is very slight at each vertebra, in consequence of the great number of joints. These several vertebræ rest upon one another by a broad basis of attachment, and they are bound together by very strong ligaments. Besides these, there is a tough cartilage intervening between each adjoining vertebra, which has such a spongy and elastic quality, that it seems of itself sufficient to allow of all the motion required for the curves. Between the several contiguous vertebræ, a passage is left for the nerves, which issue in pairs from the spinal chord.

The nerves are exceedingly minute, white, and delicate cords, proceeding from the brain and the spinal marrow. They divide into a great number of branches, with endless ramifications, and extend to all parts of the body, more especially to the muscles, viscera, and blood-vessels. They appear to enclose the nervous matter in a tough cellular membrane, called the *neurilema*, and so thin that it is scarcely perceptible. Sometimes, more particularly in the lower orders of animals, small rounded nodules, called *ganglia* are found; at one time in the trunk of a single nerve, and at others at the point of junction of two nerves.

These nerves are remarkably curious things, and maintain a mysterious correspondence between the brain and all points of the system, both remote and near. They are the telegraphic wires of that peculiar organ in man's head which appears to be the seat of his sensation, as well as the source of his mental operations.

What that battery is which works these wires, no one can tell; nor how it works them, nor how they operate by it. They transmit the intelligence as momentarily as do the wires along the railway from one station to another. Their communication, also, can be suspended or cut off in the very same manner. Unless the communication of a nerve with the brain be uninterrupted, no sensation will be conveyed. Let a nerve be divided in any part of its course, and no sense of any irritation that may be attempted on that side of the division farthest from the brain will be carried to that organ; and consequently, none will be felt by the individual suffering the experiment; but if the attempt to produce pain be made on the side of the separation next the brain, the intelligence of the irritation will be immediately transmitted. The same thing will happen if a nerve be tied up by a ligature. Compression of a nerve, too, suspends its functions of receiving and conveying impressions; and the benumbing effects of cold greatly impair its sensibility, and if of sufficient power, or of long continuance, destroy it altogether. These causes, however, seem to operate indirectly through the blood in the capillary vessels, in consequence of its circulation being arrested. Sensibility seems to predominate most where the nervous matter is greatest, and its acuteness is more or less great, as that system is more or less developed. The nervous power is supposed to stand connected, in some unknown way, with that of electricity.

If the spinal chord be divided near the *foramen magnum*, all those parts of the body with which it is connected, and they are nearly the whole, will be rendered quite insensible; while those parts of the face, which derive their nerves from the brain, independent of the spinal chord, will not be deprived of their sensibility immediately, nor at all from the same cause. Accidents of the spine interfere with the transmission of impressions by the nerves, in a manner that affords ample confirmation, that the brain is the seat of sensation.

The nerves, again, communicate from the brain as well as to it; and though the order may be carried down the same nerve which brings up the tidings of sensation from some remote part of the body, it is still not con-

ducted by the same part of the nerve, but by another set of filaments, as if a nerve were composed of two conducting strings or wires, the one for transmitting the intelligence of what takes place on different points of the frame, and the other for the purpose of acting the part of an aide-de-camp, in carrying the commands of the will from its head-quarters in the brain itself. Neither does it appear from experiment, that the one kind of nervous filament can be made to perform both functions; that is, to transmit intelligence both ways; so that that part of a nerve which takes the messages from the extremities of the body, will refuse to bring back an order from the brain.

Experiment has given something more decisive with respect to those which issue from the spinal chord. It is well known that these nerves have a double origin; that is, the one nerve proceeds from the anterior, and the other from the posterior side of that column. Now, if any injury be done to the roots of those coming from the former side, the muscles which they supply will be convulsed, without exciting any sensation of pain in the individual upon whom the experiment is made; while the complete division of those same nerves puts the same muscles entirely out of the control of the will, for they can no longer be made to contract by any voluntary efforts. But if, on the contrary, the roots of the other nerves, that issue from the posterior side of the spinal column, be injured or irritated, it will be followed by sensations of violent pain in those parts which such nerves supply; while their section or complete separation is succeeded by insensibility in the very same parts, though the power to contract them by a voluntary effort of the will remains undisturbed.

Another very striking peculiarity in respect to the nerves is, that they appear to be endowed with appropriate powers, and such as are consistent with the various functions they have to perform. The optic nerve, for instance, receives the impression of light, and conveys the image to the brain. The olfactory nerve, again, has the power to receive an impression from scent, and hence to impart the sense of smell to the brain. The nerves of the ear are capable of transmitting the

sense of sound; while those of the tongue and palate convey that of taste. The sense of touch or feeling seems common to all, at least, very nearly so. But they do not interfere with each other's prerogative; indeed, each one is quite incapable of performing any other function, with the exception of that of touch, but that which is allotted to it. Let any person well stop up his ears, and keep his eyes wide open as long as he pleases; he will yet find that the optic nerve will refuse to convey to his brain any impression of sounds. It will remain fully insensible to all tones, whether loud or soft, whether musical or discordant. On the other hand, let him reverse the experiment, and, instead of presenting his eyes to the light, let his ears be turned to it. He will soon be taught that the nerves of the ear will not act. No image will they convey to the brain, because they are not capable of receiving an impression from light. Concentrate the light right upon them, it is still in vain, for they have no passage open to the transmission of the imponderable agent. These remarks apply equally the same to those of taste and smell; yet who can detect any physical difference in the form or composition of these various nerves? This is a question that cannot be answered. It is a problem that cannot be solved. It is a mystery that cannot be known.

"The hemisphere of the cerebrum seems to be insensible to puncture and incision. Strange fact, that that part of the body in which sensations are combined, and weighed, and stored up, should itself be devoid of sensation! Parts have been removed without producing any sensation. Injury to the upper part of the cerebrum produces no convulsions or contraction of muscles. Removal of one hemisphere produces blindness on the opposite side. A pigeon, in which one hemisphere was removed, saw very well with the eye of the injured side. It heard, stood, walked, flew, and did not appear uneasy. Even when both hemispheres were removed, it had the power of flying, walking, and swallowing. It was, however, deaf and blind, and originated no voluntary movement, and was compared by Flourens to an animal condemned to perpetual sleep.

CHAP. III.

Brain, Seat of Mind. — Shakspeare's Head. — Swift's, a Disappointment. — Dr. Moore on Brain of Negro. — Relation of deep Thought with weighty Brain. — Is Mind defective?

THAT there is a very mysterious and close connection between man's mind and his brain, no one can have ground for entertaining the remotest doubt. It is evident that the capacity of this physical organisation is a measure of the power of its thought. The immaterial principle in man is blended with his materiality in a manner that nobody can understand, much less explain. Its office is most assuredly in the brain, and it performs its functions by means of that organ, though its mode of operating is beyond the power of mortal comprehension. It is a great mystery, and one that no human being is ever likely to unravel; neither is it necessary that he ever should. Undoubtedly it is best as it is. No human genius must ever expect to wend its way into this region of knowledge by the intricate paths of metaphysical refining. The tendency of such disquisitions is only to lead one into greater mystery, and then to leave him in it quite bewildered with mysticism; whereas the man of simple faith can believe the great fact of the mystery, and that it is one of God's secret things. He is therefore willing to wait the revelation of it at the time appointed; and after all, this is much the greatest philosophy, and involves much less mystery.

The union, then, of mind with matter we consider inexplicable, either to us or by us, or anybody else. Nor is it possible for any being to shut his eyes against the force of the conviction. The matter with which the sentient principle, or man's immaterial soul, is associated, and by which it performs its functions, is more complex in its structure, more tender and delicate in its composition than any other organ of the human body; hence the great care that has been bestowed upon the mechanism which was to protect it. If it be contended that mind is neither united to materiality nor operates by

it, then brain is not matter. But this cannot be denied. The connection between that organ and the thinking faculty is obviously very close. If not, why should facts show so invariably as they do that the power of thought bears an evident relation to the power of the brain from which it has sprung? We believe that all the critics of the world are now agreed that, for beauty and grandeur of conception, for fertile powers of thought, for the production of lofty intellectual sentiment, and for appropriate phrase, Shakspeare still stands unrivalled. It is said that a "large dictionary might be made of such phrases as 'win golden opinions,' 'in my mind's eye,' 'like patience on a monument,' 'o'erstep the modesty of nature,' 'more honour'd in the breach than in the observance,' 'palmy state,' 'my poverty and not my will consents,' and so forth, without end. This reinforcement of the general language, by aids from the mintage of Shakspeare, had already commenced in the seventeenth century." But what kind of brain was it that coined them? Search the picture gallery for a good portrait of this British poet, and the magnificence of the cranium will reveal the quality and power of that internal organ, which threw out such a noble exterior. A college professor, and no mean authority, once made the remark to us, when examining a portrait of the poet, that he had no doubt in his own mind that Shakspeare's head was the finest specimen of intellectual greatness that the Creator had ever fashioned. Whether that be so or not, its productions have insured it an imperishable fame. We do not speak thus to encourage devotion either to him or to his writings; for we lament that he did not throw his vast powers into a much better and a much more noble cause than that of the drama.

The cranium of Swift, whose body was exhumed ninety years after his death, when the white locks had all mouldered away from it, was a disappointment to the phrenologists, who expected that it would develop in a very striking manner the organs of wit, of causality, and of comparison. Notwithstanding, however, the disappointment in the exterior of this object of scientific curiosity, the interior of it exhibited a much larger capacity of brain than could have been inferred from

its external aspect. We have faith in the broad and general principle of phrenology, but can see very little other use in those numerous and indefinite divisions which are made to intersect the cranium in all directions, than that of converting it into a mere toy for children.

"The brain," says Dr. Moore, "of the uneducated *adult* negro resembles that of a white educated *child*, and the head of the uneducated white person retains much of the child character, size, and proportion. Mr. Owen found that the brain of an Irish labourer weighed no more than the average brain of a youth from the educated classes of the age of fourteen; and Tiedemann infers, from the size of the skull, that the brains of our uncivilised British ancestors were about the average size of the negro's . . . .

"We see that when the indwelling soul can be appealed to through the medium of appropriate senses, it is capable of visibly influencing the form and expression of the features, and of controlling the body, so far as the voluntary muscles are fit for its use. And, moreover, the prominent state of mind becomes permanently written in the face, and in the very manner of the body. This can arise only from that which feels and acts determining to a certain extent the development of the organisation. . . . If, then, the body was formed to enable the soul to experience and exhibit affections,—and these when healthy are always beauteous,—it is simply because the body and its circumstances are so far in keeping with the nature of the spirit that animates it, and therefore a free and perfect manifestation of that spirit, in whatever vehicle, must be significant only of what we are formed to admire. The body of a child, if not diseased, will continue to be beautiful in expression as long as the mind within it is kept in order by having its happier sympathies excited and exercised by fellowship with minds that manifest nothing but what is amiable. Anger, wrath, malice, and all uncharitableness, being manifested as they are by a single look, will instantly arouse the corresponding passions in a child, and these being frequently exhibited to it, will soon fix upon its features and its form the characteristics of fear

and suspicion, and foster within its heart the fierce propensities that spring from them."

Deep thought is a criterion of a weighty brain, though, perhaps, not altogether of magnitude; for it is quite possible that the brain, like other matter, may be subject to varying quality of structure, that is, to different degrees of compactness. So that two brains of equal size may differ as to quantity, and that containing the most matter be capable of putting forth the greater power. There may, then, be magnitude; but, from the want of a proper degree of concentration of substance, the corresponding amount of energy is not displayed. Hence, on this hypothesis, firmness of texture is a proper compensation for any falling off in dimension; while, on the other hand, an extraordinary development of the organ of mind is not necessarily accompanied by the presence of any transcendental talent. And perhaps the proverb, that good stuff is found in small quantities may not be wrongfully applied here.

Still it is possible for the two extremes, the best quality and greatest quantity, to meet together, though it must be admitted that Nature furnishes but few examples of such union. We can recur to a case in point. The immense height of the forehead, yet with a dome of full proportions, is at once patent to every eye that fixes itself upon it. The power of its thought is felt—not by the force of its oratory, which has no necessary connection with mightiness of thought—by every intelligent man that forms an individual of the audience it so frequently holds in the most silent suspense. It operates slowly, and the thoughts seem to move about so as to resemble more the massive structure and firm tread of the elephant, than those of the lesser form and swifter motions of the horse. But perhaps the power of this much-honoured preacher has another secret, and that is, the depth of his sincerity; every word he speaks has a meaning of a practical nature. We consider, then, that compactness of structure in brain affords the greatest facility to the operations of thought, because the thinking faculty seems to display its powers more fully when in connection with such a medium, and hence weight appears of more importance than surface.

According to our supposition, therefore, the brain, like the different metals, may be a conductor more or less perfect. In some constitutions its organisation may not be so nicely elaborated as it is in others, consequently not so fitted to fulfil the offices assigned to it. Any person, however illiterate, can perceive a difference of structure between that of a piece of marble and a piece of common limestone. Yet it is well known that they are really the same thing; that is, a composition of carbonic acid and lime, in the very same proportions. The diamond has a widely different texture from that of a piece of charcoal; yet both are the very same in substance—a piece of pure carbon. The structure affects the quality, and it is clear to any perception, that the qualities of marble over those of limestone, and the qualities of the diamond over those of charcoal, are in both cases almost infinitely more useful and superior.

Muscle and flesh, too, in different people, have different degrees of firmness of texture. Some persons' flesh is loose and flabby, and these very generally have lax energies; while those whose flesh is unyielding and full of stability, are capable of putting forth the greatest amount of energy, and often with the most untiring perseverance. Among the latter we should class Julius Cæsar, Napoleon, and Sir Walter Scott. Much, then, we think is dependent on physical organisation, as that is more or less perfect.

The evidence from experiment, that the brain is the medium of mind is irresistibly conclusive, and the declarations of fact are unequivocally strong. Amputate the foot or the leg, the hand or the arm of any person, still the thinking principle continues as before. But destroy or take away the brain, and the individual thinks no more. The latter case does not any more directly interfere with the circulation of the blood from the heart than the former; though of course it will soon stop when the seat of the intelligent principle has been removed. It may very often be seen that the forehead of idiots falls back at a very considerable angle from the perpendicular on the eyebrows: hence the cerebrum, the seat of the intellectual faculty, is in part wanting, and it only partially developes the cranium. They have there-

fore no power to think, the mind cannot operate, the physical medium is imperfect.

In general the mind apparently comes to maturity, ripens, and decays with these several stages of the body; but man's mind, or his immaterial essence, is no more matter, or a material part of his body, than is electricity a part of the electrical machine which is made to collect and conduct it. The matter of the brain, like the machine, is the instrument merely. It is the conducting medium. The machine, as a conductor, may be more or less perfect; if imperfect, the shock is not felt in all its power. But no one thinks of ascribing the feebleness of the shock to a defective quality in the electric fluid itself, but to the right source, to some defect in the instrument. Thus it is possible for the mind to be perfect also, only accidentally and unfortunately associated with an imperfect physical organisation.

On the same grounds we speak of weak or shallow minds, but strictly speaking there appears to be no positive authority for it. For no metaphysician can abstract mind from matter, and examine it alone. Nor will it ever be done. The earth was not designed to be a region of spirits. Spirit here can only make a partial manifestation of its power, because it is subject to the ever-varying and imperfect states of materiality. Man grows old, and his mental powers fail him. But that is no proof of an enfeebled mind. The brain decays, and no longer allows the functions of thought to be properly performed in it. Here it seems to resemble an imperfect electrical machine, which refuses to perform the experiment so effectually and completely as the operator desires and attempts. A skilful surgeon could not operate successfully with a blunt instrument. But the failure would not implicate his skill, for put a good tool into his hand, and he performs to everybody's satisfaction. Because mind, then, cannot develope itself through an imperfect medium, or appears feeble with a blunt instrument, we nevertheless have no proof whatever that the sentient principle itself has either decayed in the one case, or is imperfect in the other. For brain or matter is not mind, nor mind matter, nor the result of material organisation. The two things are quite different, and

man's immaterial soul has been given to him in addition to his materiality, and to him alone. God Himself has spoken decisively on this point. "Because God hath deprived her"—the ostrich—"of wisdom, neither hath he imparted to her understanding." "But there is a spirit in man: and the inspiration of the Almighty giveth them understanding."

CHAP. IV.

Brain of Animals. — Cuvier on Structures of Man and Animals. — Nervous System. — Its Use. — Comparisons of Brain in Man and Animals. — In Birds. — In Reptiles. — In Mollusca. — In Insects. — Criterion of Intelligence.

MAN, the lord of creation, presents, in almost every point of view, some marks of superiority or ascendency over all other living tribes. If he is not endowed with the same amount of physical strength as some beasts, he yet finds no difficulty in obtaining the mastery, or in maintaining his government over them all. He does this by his wisdom, which is an attribute of mind; and this it is which distinguishes him from all other animated beings. Even his structure bears all the marks of evident superiority. Though his frame has many things in common with the vertebrate animals, still the connection, the attitude, and the form of his bones present differences which serve to indicate a greater nobility, as well as a greater complexity of mechanism. The monkey tribe, which approaches man's attitude and structure more closely than any others, cannot assume his erect attitude with ease, not even the orang-outang or the chimpanzee.

"If," says Cuvier, "man was intended to walk on all fours like animals, the situation of his eyes would be directed towards the earth; but not being possessed of the cervical ligament that is found in quadrupeds, he would not be able to support his head. His inferior extremities would be too much elevated in proportion to his arms, and his feet too short to enable him con-

veniently to bend them like other animals who tre only on their toes. His chest is so large that it wou impede the free motion of his arms. He could not eve climb with so much facility as apes, because he has no like them, the great toe separated from the rest; no could he climb like the cats, on account of the weakness of his nails."

But the great distinguishing organ of the human frame is its brain. The size and the degree of perfection to which this mysterious matter attains in man, gradually, though not quite regularly, diminishes, as we descend in the scale of beings, until it becomes lost altogether, and with it vanishes every trace of intelligence. Instinct then takes its place, while just so much of brain or nervous matter is apportioned to certain animals as is necessary to render them useful to man. Hence the elephant, the horse and the dog have a quantity sufficient to impart to them the capability of being trained to perform certain things; but their education cannot be carried beyond certain limits, and these limits prescribe them to certain useful purposes.

A portion of brain and a nervous system were needful to animals, without which they could neither have properly fulfilled the functions assigned to them, nor have been so useful to man as many now are. Sensation is an attribute of nerve, and has its seat therefore in the nervous system. In this particular many of the inferior tribes surpass man in the acuteness of their powers. But in all these cases the necessity is plain. In acuteness and extent of vision man has no powers by which he can rival those of the eagle or some other birds of prey. The dog, especially the hound, is much more susceptible of scent. Nor does man appear to possess any nerve so finely sensitive as is that in the ear of an owl, which can receive an impression by means of vibrations that pass through the air and originate in the slightest motion of a tiny mouse in some distant corner of a barn. Some animals there are, too, that have nerves greatly more sensitive to touch than any that can be found in humankind. In every case, however, of such extraordinary sensitiveness there is to be seen its corresponding purpose or necessity. If it then be

asked, why the whole animal creation should not be guided by instinct, and by that alone, and why it should have any portion of brain and nervous matter at all? we should ask the counter-questions,—How could animals perform some of those delicate tasks which are assigned to them without the means of sensation? how could there be sensation without nervous or brain matter? how could they be taught to be useful to man without some glimmering of intelligence? and how could there be any sort of understanding without that matter which seems the necessary medium of mind? We conclude, therefore, that the animal economy is best constituted as it is, and answers all the purposes of the All-wise Designer much better than if instinct had been the only governing principle of the animal kingdom.

A nervous system and a cerebral are found in the vertebrated or backboned animals, and in connection with the matter contained in them various degrees of intelligence prevail. The decrease of quantity in brain, and the corresponding diminution of intelligence, do not run regular and parallel all down the scale of animal existence. No very accurate conclusions, therefore, can be drawn as to the degree of intelligence any animal possesses from the proportional amount of its brain. In the mammalia the principle holds good very generally. The weight of man's brain in proportion to that of his body varies from 1 to 22, to 1 to 35; that is, giving an average of about 1 to 27. The long-armed ape is as 1 to 40; the fox as 1 to 205; the donkey as 1 to 254; the beaver as 1 to 290; the hare as 1 to 300; the horse as 1 to 400; the elephant as 1 to 500; and the rhinoceros as about 1 to 2000.

In birds the proportion is greater; but not the cerebral portion, which is the seat of the intellectual faculties, for here the cerebellum is comparatively large. The brain of the canary bird is given as 1 to 14; the sparrow as 1 to 25; the eagle as 1 to 160; that of the goose as 1 to 360; and it is said that the cavity for the brain in the parrot is smaller than that of any other bird. From the fact of this bird being able to chatter a little, and to give a sort of expression to certain words, it might have been expected to have a larger proportion of brain; but

what display of intelligence is there in the talk of a parrot? Nor can its facility in imitating be at all the result of intelligence.

In reptiles the brain becomes exceedingly small. That of the tortoise is given as 1 to 2240; that of the sea-tortoise as 1 to 5688; and the space for the brain in the crocodile is so small that it will scarcely admit a man's thumb into it. In some fishes the brain is almost lost. In the tunny, it is as 1 to 37,000; while, however, that of the carp approaches very nearly to the proportion of that of the elephant.

It is therefore very difficult to gather any particular and precise conclusions from such an irregular gradation of facts; but the general and broad principle is plain. With the exception of a few small birds, as sparrows, finches, and bats, which are generally very lean, and therefore weigh but little, man greatly exceeds all in the proportion. The proportional weight, too, of his cerebrum to the weight of his cerebellum is much greater than that in animals; though in this particular the ox is about upon a level with him, and the dog very nearly. There are still other differences between man's brain and those of animals, all of which confer upon it some distinctive marks of superiority over theirs.

The nervous system in the mollusca is more simple than it is in the higher classes. It appears in the form of ganglia and filaments. The principal ganglion, sometimes called a brain, is situated at the entrance of the stomach above the gullet. The mouth, the tentacula, and the eyes receive their nerves from this ganglion. From it also proceed two filaments, one on each side of the gullet, and by their union underneath it form there a second ganglion, which again sends out other nerves to the different parts of the body, and in some places these form other and smaller ganglia.

In the insect the brain is situated above the œsophagus or gullet, though still in the head, but it is exceedingly diminutive. It sends out filaments of nerves about the head, and a double cord that encircles the œsophagus. These cords unite at intervals, and compose other ganglia, which represent new centres; and these not only distribute nervous threads, but appear to act independ-

ently of the original brain, so that, if the insect be separated, the sectional portions seem to possess an equal amount of vitality.

It may be said, that if the degree of intelligence be proportional to the proportional weight of the brain to that of the body, close consistency would require that the goose should have rather more of intelligence than the elephant, which is quite hostile to all fact; but then it must be remembered that no one can tell us how much must be put down to the score of quality as well as to that of weight. There are many things about the human brain, such as the peculiarity of its structure, its better position, its greater complexity and finer quality,—if we may so express it,—which are all positive evidences of its being designed for some superior work. How far, then, may it be possible for the brain of the elephant to differ in quality and structure from that of the goose? We presume the chemist cannot answer this question. Before it be answered, the assertion that the goose, in consistency with the principles, ought to have the greater amount of understanding, cannot be positively made. The general principle, however, holds good—where there is no brain there is no understanding. It is also quite evident that those animals which are not capable of being instructed, as fishes, reptiles, and insects, have the least quantity of brain and the least degree of intelligence; moreover, these are the animals to which instruction would have been of the least use as regards man's purposes; hence we find that they have not a sufficient quantity of brain to be the medium even of a glimmering of intelligence. It was not wanted, and it has not been given. Sensation *was* necessary to them, and they have a sufficiency of nervous matter, and of the right kind, to answer all the purposes it was designed to serve.

CHAP. V.

Instinct a Mystery. — Secret Things. — How Instinct operat Instinct in the Flesh-Fly at fault.

THIS word Instinct represents a most mysterious facul and one that is found in connection with both plants a animals, but more particularly the latter. Its marvello manifestations greatly excite the curiosity of all philos phers, and present subjects of meditation to every think ing mind. It makes a grand display to man's view but conceals itself from his scrutiny, as well as from his sight. It is more inexplicable to his understanding, and farther removed from his penetration than is that amazing and frightful force which often vibrates through thousands of miles in the interior of the globe, upheaving mountains on the land and islands on the sea; rending the earth in one place and swallowing down whole towns at a gulp, while burying them beneath showers of ashes or streams of molten liquid in another. The refined logic of the most acute metaphysician fails to describe the intrinsic quality of Instinct; so in like manner the nature of gravitation, which operates with the greatest nicety and force over startling distances, baffles all astronomical effort or human conception. Its laws and its perfect obedience to them have been discovered, but itself will ever remain undiscovered. The electrician collects the electric fluid, and by his skill and control over it converts it to many purposes of utility; but ask him what it is, or how it is possible for it to move almost instantaneously through the hardest substances, and he will say these are questions which involve matters that he cannot even understand, much less explain. By the use of his knowledge, and the application of his experience and reason, he is able to note the laws to which it is subject, and he has therefore its power under his control; but he remains in total ignorance of what the real thing is that he manages with so much cleverness. So it is with Instinct, —the laws which regulate it are known, but the thing itself is unknown.

The operations of Instinct are as wonderful as are the phenomena of gravity and electricity. There are some that no human art can rival, and there are others that cannot be even imitated. A rough cast in masonry is an imitation of the marten's nest, but none of the nests of any of the finches, to say nothing of those of a more exquisite and delicate structure, have we ever seen attempted; nor do we believe that the handicraft of man will ever make a near approach to them. The proportions of the bee's work are so exact, that the geometrician has been puzzled to measure them; while the most able of mathematicians have been no less puzzled to calculate the uses of such niceties. A well-trained mind has its attention arrested by such manifestations, and meditates upon them with wonder and admiration. And, though they bewilder the sceptic, their mysteries are no sources of trouble to the man of faith. He knows where to rest them in safety. The Scriptures enlighten his mind, and not only make him wise to salvation, but supply him with the key that unlocks the secret treasures of all other wisdom or knowledge.

If asked to give a definition of Instinct, we should say, it is that propensity in animals which directs or impels them to do certain things, usually for the preservation or the continuation of their species, at the fittest time and with the greatest perfection, quite independent of knowledge, without experience from themselves, and without teaching from others. It is the governing principle in the animal kingdom. It is given to control the actions of the inferior tribes of creation. To control those of man, reason is given. Instinct is therefore a substitute for reason. Though its operations are more certain, more precise and more perfect, than those of reason, they are only proofs that man is the noblest creature, since they are the results of a power which deprives the animal to a very large extent of both will and judgment, thereby showing that it has not been considered of a nature or destiny sufficiently exalted to be intrusted with a free agency in matters of choice. The brute has no choice in concerns that are of most importance to itself. It yields a blind obedience to its instinctive impulses. Its enjoyments are confined

to the physical. The pleasures of knowledge, of progress, and of discovery are all withheld from the animal. Mental pleasures are peculiar to man, and they are infinitely more exalted than the sensual, which are peculiar to brutes. The faculty of Instinct teaches —if the expression be allowed — the animal how and where to seek the food best suited to its own constitution; impels it to bestow just so much care in cherishing its offspring as is necessary to bring them to maturity, or till the time they can provide for themselves, and no more; and how to defend either itself or young from danger or attack. These purposes being answered, the operations of instinct proceed no further; the animal has no desire or motive beyond them, if indeed it has any motive at all. Reason has motives and pleasures in addition to these, as the sequel will show.

Much has been written by the ablest pens, and no less produced by the most profound in philosophy as to the nature or essence of instinct and the manner by which it operates; and we think all to no purpose. Both subjects are exceedingly obscure, and we have seen no light thrown upon either, nor shall we ever expect to see any; for our belief is that it was never intended that the human mind should be able to explore them. We shall therefore have but little to say upon these questions, which shut up all investigators to despair.

In the world of nature, as well as in the world of spirits, there are things secret and things revealed; that is to say, concealment and a revelation of second causes. For it is not competent to the powers of mind to grasp or fathom the first cause of anything. And surely it does not require a very powerful intellect, or a vast range of observation, or a very sure judgment, or the presence of an extraordinary share of common sense, to render a person capable of discerning a difference between the conditions, relations, and consequences of the one and the other. Let us look into the Scriptures, and take the plan of salvation as an instance, and we shall find, whether we refer to doctrine, to precept, or to example, —whether to future rewards or punishments,—all that is necessary to guide, to encourage, or to warn the fallen

race of Adam is fully made known to them. So far, then, as these things are concerned, all is clear. On the other hand, the things which are dark, symbolical, or mysterious are among the matters that minister nothing more necessary for sinful man to know than what He has already revealed to him. And that many things are kept secret—are profound mysteries to man—must be considered a wise and useful provision in the economy of redemption; for, if the Divine Being had made a revelation of all His awful and sacred mysteries, where would there have been any object for the exercise of the good man's faith? The work of faith is a contemplation of their revelation with a full and firm belief in it. These meditations are sources of infinite pleasure to the devout and Christian mind. So much so, indeed, that such a Christian will at any time say, that Divine Wisdom has well and wisely concealed many of His ways and purposes. He may ponder them, wonder, and admire; but he is quite satisfied to leave them as they have been ordered till the hereafter shall bring all things to light, when his mind, now finite, shall then be made able to comprehend what is now dark and infinite.

Let the same rule be applied to the works of nature, and it will be seen in them also, that the useful and necessary are revealed. The knowledge of the unsearchable and unfathomable cannot be shown to be of use to man, either as a philosopher or a man of science. Suppose, for instance, that the astronomer could be made acquainted with the nature of gravitation, as well as with its laws, he would even then be no better able to calculate the time of an eclipse, of a transit, of the tides, than he does now. Nor would it be possible either for him to do it with greater nicety. But all these computations are of the greatest utility.

The knowledge of the laws of gravity, again, enable him to put even Jupiter in a pair of scales, and not only to bring out of him the weight of his ponderous body, but to tell also the density of his matter. Could anything more be obtained, though the solution of that invisible and mighty power which governs the universe were given? To assert that it could lead to no useful

discovery might be considered rash. But to say that it would confer a benefit upon the world would be much more rash; because the latter case would be presuming that the wisdom of the Being who keeps it secret is at fault. Such a presumption is inadmissible to our faith.

Thus also may we speak of the electric fluid. Here is another wonder, another mystery. Yet all about it that is useful and necessary is known, while the thing itself is unknown. It is another of those secrets of Nature which her God never intended to reveal; and when once this Divine decree has been stamped upon any one of His works, the philosopher may experiment, and the speculative metaphysician hazard conjecture till doomsday, and both will fail to make any way on ground which the Omnipotent has made His own prerogative.

We are disposed to place Instinct in the category in which we class gravitation and the electric fluid. Our belief is, that the human mind will never divine the nature of any one of them, for the very reasons we have already stated. What, then, is the evidence of the designed non-revelation of a mystery as distinct from that which fairly invites the application of human ingenuity? This is perhaps a question that cannot be answered very positively, or very distinctly. A little common sense, however, will be sufficient to hit upon a few general guides. One instance only will serve to illustrate our meaning. Some few years ago there was, as is well known, a very great excitement created in many parts of the civilised world by the wonders of animal magnetism or revived mesmerism. And it, or something like it, may be revived again before long. But what man of sense and intelligence ever believed in the foolish and extravagant pretensions put forth by some of its advocates? Yet what numbers were credulous! How superficial is the thought of the million! For here to some extent at least might have been found the point of test, that the pretensions were manifestly inconsistent with the established order of nature. They were a violation of the laws which preserve the world in harmony. Had they been matters of fact instead of pretension, they would have filled every human being with doubt and mistrust, and have intro-

duced the bane of suspicion among all classes of society. Surely there is nothing in nature or Revelation to warrant the conclusion that such a state of things was ever designed by the Creator! But quite the contrary. God has wisely set a limit to the range of man's intellect in this world; yet what has been given has been done with no sparing hand, for the field of knowledge is most spacious, and such that no one human mind will ever fully explore. But the Divine Being has reserved to Himself the power of reading man's thoughts, and this prerogative He will in nowise give to another. With man in his present fallen condition could nations or individuals transact their business, or society carry on its intercourse so satisfactorily and so orderly as they now do, if any of the parties felt assured that their thoughts were being told in some secret place or other, they knew not where? All confidence in everybody would be destroyed. Who would think this an improvement? Such is the standard by which we would estimate the worth of such extravagant discoveries.

Instinct is so much of a mystery, that man must never expect to unravel it. Its operations are so odd, and so apparently miraculous, that they strike the attention of observers more than those which are less obvious, though not less seemingly miraculous. Hence some writers have attempted to account for the workings of Instinct in almost every way but the right one. Those operations of nature which do not deviate from a course which is universal and common, though inexplicable and mysterious, are not said or thought to be any way miraculous.

Now Instinct, strictly speaking, is no more of a miracle than the growth of a common blade of grass. The one is involved in as much obscurity as the other. Neither the philosopher nor the chemist can tell in what manner a simple blade of grass elaborates the elementary matters which compose its substance. They can truly analyse it, and find the exact proportions of carbon, oxygen, hydrogen, or silica which may enter into its composition. These very elements, with all their proportions to the greatest nicety, can be obtained, and, though they be put into a crucible together, it will be impossible to convert them *into* a blade of grass, or anything like a

blade of grass. Nature has a secret that cannot be discovered — a mystery that she will not reveal. No person expects to discover it. Yet everybody knows that grass grows out of the earth, but not many think about the impossibility of manufacturing it. No art can imitate the process. The difficulty of comprehending the nature of Instinct is not at all more insuperable. The Almighty Himself is the secret of both, and neither admit of any other explanation. "It is the glory of God to conceal a thing."

Believing, then, that the Creator is the First Cause of Instinct, the question arises, are its operations performed by any second cause? that is, does the Deity exert and influence on the animal mediately or immediately? This query is as difficult as the other, and much has been needlessly and uselessly written upon it also. If analogy be any guide in this matter, it would conduct us to the hypothesis of an intermediate agent; and such is our opinion. How it is so we cannot explain, for we are unable to understand it, nor have we any means of knowing it; moreover, we shall never expect that anything in this world will put us in possession of either. Sir Isaac Newton, a good and great authority, seems to incline to the other opinion, for he terms Instinct the manifestation of an "ever-living Agent." He says the Instinct of the brutes and insects can be the effect of nothing else than the wisdom and skill of a powerful, ever-living Agent, who, being in all places, is more able by His will to move the bodies within His boundless uniform sensorium, and thereby to form and reform the parts of the universe, than we are by our will to move the parts of our bodies." Addison calls it "an immediate impression from the First Mover:" while it is defined by Hartley, Hancock, Mason Good, and Kirby respectively, "a kind of inspiration"—"the Divine energy"—"the Divinity that stirs within them"—and "the inter-agent of the Deity."

Notwithstanding all that these able writers have penned upon it, and much they have well said, the thing itself remains undetermined. The point at issue is still where it was. And here is the true explanation, that the subject lies beyond the limits which prescribe the extent of human knowledge, and man's thought cannot

even reach it; how much less, then, can his intellect grasp it? No ability, however great, no ingenuity, however acute, and no language, however precise and eloquent, can make that matter plain which neither is nor can be understood.

Since, then, the operating cause of Instinct is so concealed and mysterious, it follows that the evidences in favour of one or other mode of operating cannot be taken as at all conclusive or satisfactory. There is no standard of comparison. The infinite cannot be compared with the finite. The design of a clock or watchmaker is executed, not by his own hand, but by a piece of mechanism that he contrives for that purpose. The presence, therefore, of the mechanist, or what would be equivalent to it, the attention or superintendence of some other party, is dispensed with. He leaves his order or design in charge of the contrivance, as an intermediate agent, which is to perform his will in his absence. In this case, then, the designer does not operate immediately or directly, but mediately or indirectly. The machine may become disordered, and then it will not work; but the original designer being absent, knows nothing of it. But the operations of a clock or watch and those of Instinct do not present a perfect parallel, although our illustration may be found to offer the greatest similarity and the nearest approach that can be made. The Divine Being may leave in some unknown and mysterious manner the execution of His will to certain laws as the intermediate agents between Himself and the animals which they are made to govern. Still He is ever present, and, though knowing all that goes on in every place, He nevertheless does not interfere with the usual course of law, nor work a miracle to save an accident. The commander-in-chief of an army cannot be in all parts of the field at one time, and he sends his generals hither and thither with full directions for the proper execution of his plan. His design is thus carried out, though he may be at a distance. He acts mediately through men and officers; but this again is not a proper standard of comparison. Every other kind of finite illustration will fail if put in comparison with the infinite. The Creator stands alone in His ways,

and above all in His government and works. He is unknown, and His ways are past finding out. "Canst thou by searching find out God? canst thou find out the Almighty to perfection?"

A few remarks, however, may be made in favour of one of the two theories which are adopted to explain the operations of Instinct. It sometimes happens that an animal is mistaken; that is, its Instinct appears at fault. The flesh-fly has been seen to mistake the blossom of the carrion-plant, *Stapelia hirsuta*, for a piece of putrefying flesh; and the consequence of the mistake has been, that the maggots which should have come from the eggs of the fly could not be reared in the plant, because the food was inappropriate to them. Again, some nodules of chalk may be placed in the nest of a sitting hen as substitutes for her own eggs, and she will continue to sit as before. She has no power to perceive the distinction; and though she may turn them over with her beak, as we have often witnessed, she does not even then make the least discovery of the fraud.

It is therefore contended that, if the Creator were the immediate Guide of the animal, these mistakes could not possibly occur under His infallible direction. Lord Brougham, who seems to favour the Newtonian doctrine, says the argument is worth nothing at all; for, if the mistake be from the intermediate agent or law, it reverts through that to the Lawgiver, who could as easily have given a perfect law as He could direct it with certainty by His immediate influence. True, but the All-wise does not always do what He *could* do. And his lordship remarks, "The same Being gave the general law whom the Newtonian theory supposes to be the particular agent. Then is it not just as inconsistent with His perfections to believe He has made a faulty statute as to suppose that He makes a mistake in particular cases? Can there be any difference at all here?"

We think there is most certainly. The course of the hen's Instinct goes regularly on, without her taking the slightest notice of the fraud, because she is not conscious of it. The hen is evidently under the force of a certain law, which impels her to do a certain thing, quite independent of any knowledge of the results that it is

to produce. Now, if the hen were able to discover the deception practised upon her, and were then to refuse to sit any longer, she would show some evidence of one of two things, either that she was under the influence of an immediate guide, or that she was possessed of some rational endowment. But we find no such thing. The law of her Instinct takes its usual course, but it cannot bring forth its proper results, because an accident has interfered with the process, and by that means frustrated the object.

In the case of the flesh-fly it is quite possible that the sense of smell may interfere and overrule the law of its Instinct. This is probably a circumstance in which the two principles would be both strong, and in some particular cases the power of the smelling sensation might prevail. So that, after all, the Instinct itself might not be exactly at fault. But we do not agree with Lord Brougham when he represents the argument as proving nothing. The method of the Divine procedure is not to work miracles to make everything go right. Were He to interfere with the regular and legitimate course of any established law it would be the performance of a miracle, and this is not in accordance with the attributes of His wisdom. We, however, believe that the benevolent One does sometimes break into the natural order of things, or suspend them, for the purpose of making them fulfil some particular mission of His providence; but then such instances are exceptions to the general rule, and nothing more.

Descartes endeavoured to account for the instinctive operations of the inferior creation by the laws of mechanism. He considered that the influence of physical or ethereal agents, as the impressions of light, sound, touch, and smell, on their organs of sense, was sufficient to produce that odd series of motions which are the results of the instinctive faculty. So that, according to this theory, the animal is a sort of machine, destitute of the principle of life, yet having sensation, which is perfectly unintelligible. Lord Brougham, however, intimates that the language of the great philosopher has been misconstrued, for it does not deny life to the brutes; and that Descartes himself positively affirms that they have

it. Still his theory would ascribe the marvellous manifestations of instinct to an adaptation of organisation to the influence of external agents. Some facts to which we shall allude hereafter will be sufficient to controvert such a supposition and to banish it from all further consideration.

Buffon's theory is not more tenable. In addition to life, he admits that animals possess a faculty that can distinguish between pleasure and pain. And since their aversion to the one is so strong, and their predilection for the other so obvious, he thinks these predilections and aversions will account for all the marvels of Instinct.

CHAP. VI.

Bee's Stupidity. — Line of Demarcation, as between Instinct and Reason, where? — Effects of Sin in the World. — Man's Instincts. — Faculty of Wit. — Presence of Mind. — Clive's. — Napoleon's. — Providence.

But the theory which is most rife with the evil genius is that which identifies Instinct with Reason. Dr. Darwin appears to attempt to steer the argument to this issue. His sea is very rough, and the waves throw him back upon his own shore. He merely performs a circle upon the waters, yet is quite satisfied that he has got safely over to the other side; for, being without chart or compass, he has nothing to convince him that he has made no head.

In his Philosophy of Natural History Mr. Smellie maintains "that between Reason and Instinct there is no difference, and that the reasoning faculty is itself the necessary result of Instinct." According to this notion, then, the bee and other insects which display proofs of the purest Instinct, ought to possess the greatest share of reason; more by far than the dog or the elephant — more than even man himself. One fact alone will falsify the assertion. Obstruct the passage of a bee homewards, or turn it out of its

course just at the hive on its arrival home, and what animal will exhibit more profound stupidity? We have often seen them put upon the most rapid wing by the sudden indications of a thunder-storm; and the house in which it was our good fortune then to live was situated between the flower-garden on the south side, and the kitchen-garden on the north. The latter contained a large stock of hives, and one large room in the house had windows on both sides, one opening into each of the two gardens. In the summer both windows would occasionally be open at the same time, and then the industrious insects found a passage quite through. But we have known the window nearest the hives to be shut, while the other has been open and a storm rising. The bees have rushed in at the open window as usual, and wafted themselves across the room with a speed which has made them quite invisible; but, instead of passing clear through, they have knocked their heads, not against the wall, but against the glass of the shut window with a shock that has been apparently sufficient to break the panes; though, having fallen to the floor by the force of the stroke, they have soon recovered themselves. Now, what course, in this embarrassment, have these busy creatures, which are so apparently rational and wise in some matters of the greatest difficulty and nicety, pursued? Most certainly not a rational one; indeed, it has been quite the contrary; for they have mounted the window and tugged away at the glass with energy and anger, as furious as the motive has been stupid. All their efforts have been directed to go ahead; it was the way of their Instinct. Now the presence of any reason would have taught them to go back, and make their escape at the open window; and we have many times seen dogs do this without any hesitation. But this course never seemed to occur to the bee. Where, then, is the reason that some persons will accord to these tribes of being, although they are so skilled in the principles of geometry? Nothing can be more conclusive. Instinct, therefore, is not Reason, but something very different from it. Neither is Reason the necessary result of Instinct.

The difficulty of defining the line of demarcation

which is suppposed to run between Instinct and Reason is a source of great perplexity to some people. They cannot discover with exactitude where the one begins and the other ends. This may be. It may be also they have not the ability to do it. It is probable, too, that they are incapable of understanding it; how, then, can they expect to define it? Will such people tell us to a moment, to an hour, or to a day, or even to a week, when the winter season terminates, and that of spring opens? Will they, furthermore, tell us, with the greatest exactness of time, when daylight closes and darkness sets in? Yet nobody calls spring winter, or darkness light. They border upon one another in a manner that cannot be described. So do Instinct and Reason meet each other in some way that is not perhaps intelligible to man's powers of reason. It is not to be supposed that they infringe the one upon the other, with the same plain surfaces each to each, as do the copper and zinc plates in a galvanic battery. Does not their meeting more resemble that of nature than art? The geologist is often unable to point out the spot or the line which marks the separation of two strata of rocks; neither can his assistant naturalist define the limits of any one group of animals by their fossil remains. This feature in nature seems quite universal; nor is it a characteristic of the organic world only, but the same principle of merging is seen with regard to life itself. It cannot be discovered where animal life begins, nor where that of the plant ends. Hence we have plant-animals. Such appears to be nature's rule, and Instinct and Reason form no exception to it.

Before entering upon the facts illustrative of instinctive operations, let us receive a very necessary and useful premonition. The student of nature must ever bear in mind that sin, having entered into this world, has, to a certain and fearful extent, disordered the harmony and beauty of her admirable economy. To show how far, or in what manner it has done so, is a duty we do not here impose upon ourselves. All that we wish now is, to direct the attention of our readers to the fact, and ask them to hold it as a basis of faith, by which the reconcilability of anomalies that would otherwise greatly

perplex them may appear more than possible. The knowledge of the effects of sin may be considered the key that will unlock some of the doors in the temple of mystery. Let it be rightly applied, and a satisfactory entrance will be made. No one, however, must feel surprise if all, even then, cannot be opened. Sin may be said to partake of the infinite; man's knowledge, therefore, which is finite, cannot comprehend it; how, then, can his mind understand it, and how can his ability explain it? The effects of evil are more wide-spread, more deeply sunken, and more complete than any human being knows or even believes. They have made greater havoc of the human heart than that heart has ever felt, be it that of a Bunyan or a Baxter. Who among men can wipe away the dark and foul stain sin has fixed upon every man's soul? Yea, an angel cannot do it. These facts present an important item of consideration in the study of God's works. Without it, indeed, many things must appear doubly obscure and dark. The Christian will meditate upon it, and obtain from it some light in a dark place, although the thoughtless and the profane pass it over as a matter of little consequence, and therefore of little worth in the argument.

The more immediate subject contemplated for illustration in this little work being the manifestation of pure Instinct, we purpose commencing with the highest order of beings in which its power makes the least display of itself, and tracing it down the scale of existence, making the space devoted to it proportional to its development, until at length we arrive at the point of its full meridian, where it shines forth with the most marvellous lustre.

Man, then, who wears the diadem of reason, will soon be disposed of, for his instincts are mostly of the physical or mechanical kind, which we have no intention of treating at any length. His heart is the centre and prime-mover of his organic life, even as the brain is the centre and the authority that sets in motion all the functions of animal life. The operations of the former are performed involuntarily; the latter by the exertion of will. The heart beats without the individual being conscious of it; and, though the rising of the passions will quicken its pulsations, there is no opposing power that

can stop them altogether. Closely connected with this is the mechanical or automatic act of breathing, over which the will can exercise a partial control; but it is very limited, for the action cannot be long suspended. The blood must come in contact with atmospheric air, to be cleansed of its carbonaceous matter, or death will speedily ensue. The action determines to go on regularly and constantly, whether one is in active wakefulness or in quiet sleep; the work therefore has not been left to be done either by will, which is sometimes capricious, or by reason, which can only act intermittingly, and, moreover, is liable to err; but it is given in charge of certain muscles, which expand and contract the chest independent of either.

Some other motions of the body there are that are remarkable for their momentary duration. That one of the eyelids, by which the eye is closed against danger, real or imaginary, is not a little striking. This, unlike the others just named, is said not to be the result of any mechanism, inasmuch as infants do not, at least until some days after birth, close their eyelids on the approach of external objects. But, whether its cause be more instinctive or habitual, the motion which takes place every instant has a use, for it is necessary in order to preserve the lustre of the eyes. Neither can the power of will long suspend it. Then, again, the instant a man loses his balance his arms are instinctively thrown out to prevent a fall, or to bring him back to the perpendicular. The motion is made so instantaneously, that there seems no time whatever for it to be the result of either reason or will, which require a moment of thought, at least to decide the course necessary to be pursued.

The accommodating power in the iris of the eye, which dilates and contracts the pupil, is from an instinctive principle. The will has no concern in this operation at all, nor has reason either; indeed, the mind is totally unconscious of the performance, does not even subsequently know that any change has taken place. The eye is an optical instrument of the most wonderful complexity and delicacy, while at the same time it is replete with the most admirable contrivances. We have the

nicest evidence from the one now under consideration. The optic nerve, which comes from the brain, expands its extremity over the back part of the eyeball in the form of a net-work, and on that account it is called the retina. This expansion of nervous matter is the seat of vision. The image of any object is thrown upon it, and the optic nerve conveys the impression to the brain. A certain portion of light is necessary to make the figure distinct, but too much only dazzles and makes great confusion. While an intense light, moreover, produces pain, and inflicts an injury. But the guard stands at the door ready at a moment's notice to act upon orders from within. The instant an intense light begins to enter the door-keeper receives the admonition. The iris commences to converge immediately, though with slow motion, and as the diameter of the pupil becomes smaller, a less quantity of light is let in. The reverse operation takes place when the light is feeble, and more especially so in the darkness of night. In the latter case the pupil is opened to the fullest extent of the iris, in order that all the light possible may be collected. But the motor power is not in the iris itself, for if, through disease, the optic nerve or the retina be rendered incapable of transmitting impressions to the brain, the iris remains quite steady; in short, perfectly immoveable, although its own structure is complete and healthy, and in no way incapacitated for the proper performance of its functions. The officer at the entrance therefore receives the commands to act from the authorities inside. These orders are transmitted through the sixth pair of nerves, a filament of which joins the ciliary nerves in the lenticular ganglion, and these are traced to the iris, which is a sort of curtain composed of muscular fibres. Here, then, is a motion of physical instinct, and one over which the will exerts no influence.

And probably man has but one instinct that can be denominated of a purely mental character, and that is developed in his early infancy, at a time, it must be observed, when reason has not even begun to dawn, and before any experience has been obtained or any instruction communicated. Something, then, is wanted as an equivalent, *either* to reason, or experience, or in-

struction. Something to supply their places until they are in a capacity or condition to do their own work. Now, Instinct is the equivalent: and that is given and ready to act, be it remarked, just at that particular time in a person's life when it is wanted, and that period, too, is a very short one; for no sooner has reason assumed her powers than the mental instinct disappears, and returns no more during the period of the longest lifetime. Who but the All-wise could know when such an instinct would be required? and who but He who created the being could provide for it an infallible though mysterious guide?

The writer of the article Instinct in the seventh edition of that magnificent book, the Encyclopædia Britannica, sums up the evidence of the instinctive faculty as being the guide of the infant thus: "A healthy and vigorous infant within ten minutes of its birth gives the plainest and the most unequivocal evidence of a desire to suck, before anything be brought into actual contact with its mouth. It stretches out its neck, and turns its head from side to side, apparently in quest of something; and that the object of its pursuit is something which it may suck every man may satisfy himself by a very convincing experiment. When an infant is thus stretching out its neck and moving its head, if anything be made to touch any part of its face, the little creature will instantly turn to the object, and endeavour by quick alternate motions from side to side to seize it with its mouth, in the very same manner in which it always seizes the breast of its nurse, till taught by experience to distinguish objects by the sense of sight, when these alternate motions, being no longer useful, are no longer employed. If this be not an instance of pure Instinct we know not what is. It cannot be the result of association or mechanism; for when the stretching of the neck takes place nothing is in contact with the child's mouth, and no association which includes the act of sucking can have been formed. Associations of ideas are the consequences of simultaneous impressions frequently repeated; but when the child first declares, as plainly as it could do were it possessed of language, its wish to suck, it has not received a single im-

pression with which that with can possibly be associated."

It may be further observed, that the child makes the effort to suck, not to chew like its parent; and the action of sucking is the only appropriate one under the circumstances. The mouth, moreover, is directed to any object of contact, and no other member of its body. Why that, for aught the child knows, rather than the nose, or the eye, or the hand, or even the ear? Who teaches it, and in what manner is it taught that the mouth is the proper receptacle, and that sucking is the appropriate action? It is quite evident that the infant knows nothing of either, or of anything else.

The eyes of a newly-born infant are open, but it does not appear to see; for it will not wink at the approach of an object, at least until several days after birth. And it requires forty days to produce a smile, and as many to fetch a tear.

If there be anything at all in subsequent manhood that is any way allied to mental instinct, it must be that particular faculty which responds *impromptu* with the most befitting matter. It seems a faculty, the natural tendency of which is to associate in the most ready and certain manner. Let an instance or two just illustrate our meaning. It appears that on one occasion an individual dropped a remark upon the good fortune which brought home Sir Francis Drake in safety from so many long and dangerous voyages. This observation brought out the following from another party immediately: "Truly it is strange that in all that time he was never *ducked*."

Lord Falkland was elected to sit in Parliament when quite young, and some members objected to his admission on the ground that he had not sown his wild oats. "Then," replied the youthful member, "it will be the best way in the world to sow them in this house, where there are so many geese to pick them up." Perhaps the greatest exemplification of this faculty in the present House of Commons is to be found in Mr. O——, the member for M——, who is well-known, probably too well by his antagonists, to have that bow always abiding in strength, and that the arrows he lets fly from it

never fail to pierce the very heart of the foe. Two or three years since, while representing the members of a certain cabinet as fawning to the people, and no sooner getting into power than they turned with scorn upon their supporters, he applied some lines from Swift with remarkable appropriateness and effect. They were the following: —

> "They forgot the dunghill whence they grew,
> And thought themselves the Lord knows who."

But men of the most brilliant and dazzling wit are not the most profound or original thinkers; nor do they appear to possess judgment of the most solid worth. Still wit is a quality which pulls others in its wake. Its very tendency is to inform, quite in spite of a man's liking. Hence the mind of a wit is often of more than average fertility, and possesses a greater amount of information; while his understanding is above the average in power and quickness. In society it is the brightest ornament, and gives its possessor an advange over everybody else. But a man of shrewdness and of good common sense will always be disposed to suspect the judgment of a flashing wit. Though the faculty may be polished, it can never be imparted. It is an inherent quality, and appears to act independently of the manner that is characteristic of mind, or of the reasoning powers. Reason takes at least some time to compare and judge. But the finest strokes of wit are for the most part given *impromptu*. This particular mode of acting bears a close resemblance to that of Instinct. It differs, however, from that of Instinct in this, that it is the effect of the power of association in some measure, while that of Instinct is not so. But, whether the associating power is instinctive or not, we do not feel competent to offer an opinion.

We may here just notice also another mental quality, very much like the preceding, called *presence of mind*, and which is often a characteristic of the greatest commanders. In this case the promptness may or may not be equal to that in the foregoing. The faculty of presence of mind displays itself in an overpowering crisis, and either intuitively, or by the force of reason

pounces upon an expedient which suddenly opens a door of escape from otherwise an inevitable catastrophe. The evidence is that no alarm has thrown reason off her guard, so as to deprive her of the power to act. The sudden and loud clap of thunder does not strike her machinery with effect enough to put it in disorder. Reason continues to sit upon her throne without being thrown from the attitude of command, and without having the balance of her powers disturbed. She is therefore in a capacity to perform her proper functions; indeed, such is the meaning of presence of mind. Are, then, the operations of presence of mind the results of the reasoning faculty? or are they the productions of an independent power, or of both combined?

In India, rather more than a century ago, the celebrated Clive found himself in a very awkward and unpleasant dilemma, and saved himself from a consequent disaster by his remarkable presence of mind. Captain Clive was then at the head of about 6000 troops on an expedition against M. Law and Chunda Sahib. Having seized the village of Saniavarum, he formed it into a fortified camp. The enemy conceived the design of taking this camp by surprise in the night, and in the absence of Clive, who had gone with a part of his forces to intercept a body of the foe. The column destined for this nocturnal exploit consisted of about 780 men, among whom were some English deserters, and some spies, moreover, had found their way into Clive's camp. The outer trench was reached at midnight, and the leader was there informed by one of the spies that Clive had returned to the village. The assailants, however, passed on, headed by the English deserters, who, when challenged, declared themselves to be a reinforcement sent for Clive from Major Lawrence. They were therefore allowed to penetrate the camp unopposed; and having surrounded the bivouac in which Clive lay asleep, they opened their fire. A sudden panic seized the sepoys, and consternation filled the camp. Clive started from his sleep, and the first man he met rushed upon him with the sword. A momentary struggle with his adversary, and the man fled. But, before Clive knew the cause of the strange tumult, he suddenly found himself

in the midst of six French soldiers. The moment was critical, and within its small space lay the problem of his salvation. In that short period of time, however, he solved it, by assuming the tone of a conqueror, and telling his besiegers, with the utmost self-possession and coolness, that, if they rejected the terms he now came to offer them, they should all be put to the sword without mercy. The stroke was like a shock from a galvanic battery. Three of the six Frenchmen threw down their arms upon the spot, and the other three ran away.

Napoleon, too, extricated himself in a similar manner, only on a much larger scale. It was after the battle of Castiglione, in 1796, when and where the Austrians under Wurmser were completely put to the rout. A division of the Austrian army, consisting of about 4000 men, was wandering about in search of a road by which the defeated general might be reached in safety. Suddenly the lost troops came upon Lonato, and their chief was informed that a force of 1200 Frenchmen only was left in the town. The place being so entirely surrounded, the Austrian commander sent a summons for an immediate surrender. Fortunately for the French, Napoleon had just entered Lonato, and having assembled his staff and his guards around him, ordered the officer with the summons to be introduced. The bandage being removed from the eyes of the Austrian, Napoleon, with a stern countenance and firm tone of voice, asked, "What means this insolence? Do you beard the French general in the midst of his army? Go, tell your commander, if it be his intention to offer an insult, that I am here; that it is himself who is my prisoner; therefore, if in eight minutes his troops do not lay down their arms, if a single gun be fired, I will cause every man to be shot." The Austrian commander then offered to capitulate; but "No," replied Napoleon, "you are all prisoners of war, and must surrender at discretion." Four thousand men immediately grounded their arms at the tone of a single individual, and nothing more. Thus the prison-door, which was already shut upon the rising Corsican, and only wanted the bolt being put in, was suddenly thrown quite open, he walking quietly out, and his numerous foes walking innocently and securely in.

Many more instances of the kind might be cited, but the two examples we have selected are sufficient for our purpose, and they furthermore illustrate the same principle with a difference. In the one case there was ample time for reason to perform her functions legitimately; while in the other, the time, which was comparatively none at all, seemed quite insufficient for her to make a single act, much less a number in succession. There can, however, be no doubt that the faculty which saved Clive from inevitable death at Saniavarum was the same in kind as that which delivered Napoleon from a prison at Lonato. And there is every reason to believe that the latter person, under the same circumstances, would have performed the act with as much promptness in Italy as the former did his in India. The same high authority we have just previously quoted states, "We think it may be safely affirmed, that no action, whether of man or brute, which is deliberately performed with a view to consequences, can with any propriety be said to proceed from Instinct, for such actions are the effect of reason influenced by motives. Deliberation and Instinct are obviously incompatible. In the natural works of animals, which are confessedly under the influence of Instinct, we perceive no symptoms of deliberation; but every one, when not interrupted by external violence, proceeds without hesitation in the direct road to an end of which the animal itself knows nothing."

Still these facts do not afford proof that presence of mind is an instinctive quality. Neither is such the writer's meaning, for he is making no allusion to our case. But the presumptive evidence is strongly in favour of reason as the motor power; for presence of mind implies a capacity to act. And it must be remembered, in the next place, that thought is quick beyond conception, so much so, that there is but one other known agent with which it is or can be compared. It may be said, therefore, to be more of an ability than of an Instinct. If the faculty be instinctive at all, it certainly does not resemble animal Instinct in its most distinguishing feature. For the animal Instinct is in no way capricious, but steady and uniform, both as to its power and to its operations. The same species *possess* it in the same degree. There

is no inequality of skill between any number of bees, for instance; or any between those same busy creatures in England and those in any remote country, as China.

The same thing cannot be affirmed of man's presence of mind, for not one in a thousand possesses this remarkable quality to the extent of the two cases we have described.

We, however, believe it to be a faculty of some kind, and not a distinctive mark of Divine Providence. And we shall take the opportunity to state here that there are many marvellous operations of animals upon record which must be attributed, not to Instinct, but to some particular interposition of Divine Providence, "either," says Kirby, "to prevent some calamity, or to produce some blessing or benefit to the individuals concerned. Thus the account of Sir H. Lee's dog, mentioned by Mr. French, which saved its master's life by taking and maintaining its station, which it had never before done, under his bed: and that given by Dr. Beattie of a dog who, when his master was in a situation of the most imminent peril, after fruitlessly attempting to save him, ran to a neighbouring village, and by significant gestures at last prevailed upon a man to follow him, and saved his master's life. These, and many more such cases, can scarcely be regarded as belonging to the ordinary Instinct of the species; for if they did, more murderers would be disappointed of their intended victim by the agency of his or her dog. I knew myself an instance in which a most valuable life was saved by a dog which, being condemned to the halter by a former master and escaping from those appointed to despatch him, at last established himself, after repeated expulsion, in my friend's family; and afterwards, there is every reason to believe, by the sacrifice of his own life, prevented his master from being drowned. These cases are remarkable; but they do not appear to belong to Instinct, but rather to the doctrine of a particular Providence."

CHAP. VII.

Monkey Tribe. — Chimpanzee. — His Brain — Strange Habits. — Does not Reason. — Ourang-outang. — Remarkable Death. — Gibbons. — Method of catching Apes. — A Baboon. — Imitating Propensity. — A preaching Ape. — Monkeys. — Their curious Habits and Antics. — Lecturing Monkey. — Monkey Craft. — A Crow punished. — Strange Defect of Memory. — Monkey's Gravity.

We take this tribe of animals next because they are said, or supposed, to possess more of the rational faculty than any others of the irrational orders of being. But there are some facts, which we shall hereafter mention, that put out the notion that the creatures belonging to this tribe are capable of reasoning; and they show, moreover, that not one of them has the ability to take one single and complete step in that direction, not even the most simple in the process. Naturalists distinguish them by the general term *quadrumana*, or four-handed animals.

There are several particulars, both in the structure and manners of these animals, that make the tribe appear the oddest in the whole creation. On that account monkeys always excite a strong and curious sensation in the minds of all young people; while, with no less force, they arrest the attention of the philosopher and the man of thought as to what can be the object of their being. Indeed, their ludicrous mimicries, their inimitable grimaces, their ever-varying antics, and their mischievous inquisitiveness, never fail to amuse and delight all classes of people of all degrees of intelligence; and what in them is most singular and odd in appearance is that solemn seriousness with which they perform all their actions, and which gives the most decisive evidence that they are destitute of the sense of the ridiculous. It is true there are some men also who appear insensitive to the power of the ludicrous, for they will both describe such facts and mimic the buffoon with the most solemn gravity, while the matter itself, or the action of it, is sufficient to keep a whole crew or company in roars of

laughter. But this seems owing to some particular command such individuals have over themselves, rather than to the absence of the faculty to appreciate it, for few men only have the power to exercise that controul over their risible faculties. Not so in the animals of the monkey tribe. All exhibit the most profound seriousness, and everything they do is droll. And it is their antic postures and comic actions, in connection with so much apparent solemnity of demeanour, that strike man's attention, and excite his laughter, in spite of the disposition of his mind to meditate upon the great singularity of the phenomena. There is also another feature in the aspect of the phenomena that is no less striking; —it is the evident absence of the reasoning faculty from a structure which seems at the same time to warrant its presence. The near resemblance the frame and the attitude bear to those of man makes him suspect that, after all, reason must be lurking there too. The power of the association has become so strong in his mind, that he cannot well rid himself of the impression, and has a difficulty in believing that the creature of such a formation is a mere animal. Hence the remark was once made with regard to the higher families of the order, that they could both understand and speak, but would not, lest they should be called upon to labour.

Their resemblance to the human form imparts an interest to all their doings, and invests them with a sagacity and shrewdness that are apparent only, and such as no other animal possesses. Between the most debased savage and the most intelligent family of the monkey tribe there is an immeasurable distance, as will be subsequently shown; for the tendencies of the aspirations are in opposite directions, and well put by Solomon when he asked, "Who knoweth the spirit of man that goeth upward, and the spirit of the beast that goeth downward to the earth."

Simiadæ is the classical appellation given to the apes in general. These are limited to Asia and Africa, while the monkeys are found in great numbers in the new world, both north and south, but in the latter more especially. The rock of Gibraltar is the only spot on the continent of Europe that is inhabited by any of the race, and they have now established here a flourishing

colony, having probably sprung from the coast of Barbary some generations ago. The appetites of the order are somewhat accommodating, and in this particular resemble more that of man's, but their habits of life are essentially frugivorous, and their food for the most part consists of fruits, which they find upon trees. A remarkable adaptation of structure for climbing and gathering enables them to collect their food with ease. The trees, too, upon which they climb, afford them a certain security from the beasts of the forests below them, or they would be an easy prey to the panthers, leopards, and serpents. Their creator, then, has given them a peculiarity of structure every way suitable for the purposes it has to serve.

The Chimpanzee, Troglodytes, is considered to make the nearest approach to the human being, both as to figure and rationality. Put, however, a skeleton of each side by side, and the most inattentive observer cannot fail to be struck with the difference. In that of man, there is an erect attitude which bespeaks a magisterial deportment and power, altogether wanting in that of the ape. The latter, in comparison with the former, seems the very picture of decrepitude and decay; the one appears to represent some marked deficiency, while the other exhibits a fitness for some superior intelligence and authority. Such is the impression indelibly fixed by a simple view of the two skeletons in contact. And it is quite impossible to escape from it, though the power that leaves it cannot be defined. Indescribable is the presence of that something seen in that of the man; while its absence in that of the ape is indescribable likewise.

Such is the general aspect, and an examination of the particular organization of each presents the animal as wide apart from the man as ever. Some parts of the former's dental apparatus are apparently designed as weapons of defence or attack. Their canine teeth, for instance, are quite formidable, being long and prominent. They are, moreover, separated from the neighbouring teeth by a break or an interval, and each one often requires for its point a corresponding socket in the opposing jaw. Now man's teeth are arranged in either

jaw, in one uniform and unbroken series, and there is nothing about them indicative of means either of defence or attack.

Their voice again is different; in short, the apes cannot give utterance to sounds. The very structure of the larynx deprives the animal of that ability. There are two membranous sacs which communicate with the glottis, thus raising barriers to the production of sounds, and thereby showing that these creatures were never intended for the delivery of speech. Furthermore, their back bones have three vertebræ less than those of the human skeleton. Also the ape's tongue is differently formed, and as such is a very inferior instrument to that by which man performs so many nice operations. If a skeleton each of man, of a chimpanzee, and of an ourang, be put side by side, the arms of the two latter will appear out of all proportion, those of the chimpanzee reaching to the knees, and those of the ourang even touching the ankle joints; while those of man fall far short of his knees.

But the great distinctive mark, and the only one we shall mention, is to be found in the skull, although the chimpanzees and the ourangs make the nearest approach to the human head in the form and structure of cranium, as also in the quantity of brain they contain. Hence they appear to be capable of receiving a corresponding amount of instruction. Accordingly they may be taught to do certain things quite beyond the reach of other animals' understanding, and beyond the power of any others to execute, even could they be made to understand them. A few of these things will be noticed.

The reasoning or intellectual faculty develops itself in proportion to the development of brain in one's forehead. If the organisation of the latter incline backwards, there will be found, in all probability, a deficiency of intellect; but if it runs up perpendicularly from the floor of the nostrils and the *alveoli*, or sockets of the teeth in the upper jaw, then it may be concluded that the nervous matter within is situated in the right place to have the command of its proper work.

If a line be run down the front of man's forehead to the base of his nostrils, close to the roots of the incisor teeth in the upper jaw, and then another taken from

that point towards the bottom of his ear, in an horizontal direction, his cranium will be included between those two lines, and the angle they subtend is called the *facial angle*, or the *facial line*. The method followed by Camper is to carry the horizontal line from the base of the nostrils at the point named, to the external orifice of the ear. According to this method, the cranium of a young ourang was found to subtend an angle of 67°. But that of the European infant subtends an angle of 90°, or a quarter of a circle; that of the European adult gives 85° only, and falls to 75° in the aged European; that of the American monkey subtends one of 65°; that of the young mandrill 42°; that of the pug-dog 35°; and that of the horse only 23°.

But if the line from the base of the nose be carried, as is sometimes the case, to the occipital condyle, which is lower down than the external orifice of the ear, the angle will be larger than that taken by Camper's method. According to this mode of taking it, that of the European adult measures 95°, and those of animals in like proportions, so that in either case the most intelligent animal in the whole creation, or that which is considered so, has a cranium that falls about 55° less than that of man. Or the angle subtended by the skull of the chimpanzee, which is about 40°, if taken by the latter method, is only about two-fifths of the measure given by the human head. As to the habits of this wild man of the woods, we cannot find anything more to our purpose than the account given of him by Battel, a Portuguese traveller, and it is from the Encyclopædia Britannica that we quote it.

"This pongo," he says, "is exactly proportioned like a man; but he is more like a giant in stature, for he is very tall, and hath a man's face, hollow-eyed, with long hair upon his brows. His face and ears are without hair, and his hands also. His body is full of hair, but not very thick, and it is of a dunnish colour. He differeth not from a man but in his legs, for they have no calf. He goeth alway upon his legs, and carrieth his hands clasped on the nape of his neck when he goeth upon the ground. They sleep in the trees, and build shelters from the rain. They feed upon fruits that they find in

the woods, and upon nuts; for they eat no kind of flesh. They cannot speak, and appear to have no more understanding than a beast. The people in the country, when they travel in the woods, make fires where they sleep in the night; and in the morning, when they are gone, the pongos will come and sit about the fire till it goeth out; for they have no understanding to lay the wood together, or any means to light it. They go many together, and often kill the negroes that travel in the woods. Many times they fall upon the elephants which come to feed where they be, and so beat them with their clubbed fists, and with pieces of wood, that they will run roaring away from them. Those pongos are seldom or never taken alive, because they are so strong, that ten men cannot hold one of them; but yet they take many of their young ones with poisoned arrows. The young pongo hangeth on his mother's belly, with his hands fast clasped about her, so that when the country people kill any of the females, they take the one which hangeth fast upon its mother, and being then domesticated and trained up from their infant state, become extremely familiar and tame, and are found useful in many employments about the house."

From the same authority we learn also that a young negro was once carried off by an African ourang, and was maintained during a whole season in the society of these animals without being injured by them. He returned in safety, and reported that they had never put him to inconvenience, but seemed the rather delighted with his company, especially the females, who brought him fruits in great abundance; and, when necessary, defended him with very great courage from the attacks of serpents and other beasts of prey. In like manner, they have been known to carry off also the negresses, whom they have then obliged to take up their dwelling among them. These singular animals never appear to have starved their human captives, or have put them to any hardship; on the contrary, the negresses were carefully attended to, well fed, and pertinaciously defended. And it is stated that M. de la Brosse knew a negress at Lowanjo who had lived three years in company with these odd creatures, before she had an opportunity of effecting *her escape from them.*

The great ape, or black ourang, of Sierra Leone, remarkable for its strength and likewise its industry, has been found, when properly trained and fed, to be domestically useful; but when sent to the river for water, and the pitcher not being taken from it immediately on its return, it will let it fall to the ground. And seeing the jug smashed in pieces, it utters forth a lamentable cry.

Pyard says that he has seen them trained to hand the beverage to company at table, rinse out the glasses even, and also turn the spit. It is stated in Brown's anecdotes that M. de Grandpré saw on board a vessel bound for America a female chimpanzee, which exhibited some proofs of astonishing intelligence. She could not only heat the oven, but could recognise the moment when the necessary degree of heat was attained, and would then fetch the baker to put in his dough. It was necessary to see that no live coals fell from the oven into the ship, and it is said that she was careful to observe this duty likewise. She would furthermore assist the sailors in splicing the ropes, and in handling and unfurling the sails.

In the same country, Lieutenant Sayers describes them as being exceedingly watchful, and quickly discovering the approach of strangers. The first one that makes the discovery gives the alarm immediately. Hearing them for the first time, Sayers was much startled by the peculiarity of the cry, which somewhat resembles the voice of a human being in great distress. It was on coming near a jungle, and the alarm was no sooner given than the whole wood appeared quite alive with their numbers. His guide, a native, assured him the whole would instantly leave the trees which exposed them to view, to seek concealment in the brush-wood below. The native showed signs of fear, and entreated the lieutenant to proceed no further in that direction.

In the dense forests of Sierra Leone, Guinea, Congo, Loango, and other like places, these beings live in troops, and take up their their abode in the vicinity of some deserted village, but more particularly in those which produce the papau tree most abundantly, the fruit of which they are very fond of. The huts they construct

are nearly in the form in which the natives build their houses, and are covered with leaves; but these habitations seem intended only for the females and their young, since the males have always been found to lie on the outside. When, according to Lieutenant Matthew, any one of them is shot, the rest give immediate pursuit to the destroyer; but their vengeance is satisfied if they can seize the gun that they had seen to be the instrument of the mischief. This they smash to pieces with all imaginable rage, while they leave the fugitive, their real aggressor, to effect his escape. This is a very fortunate turn in favour of their assailants, for one blow of their paws is said to be sufficient to kill the strongest man, and some of their skulls, which have been sent to England, render such an assertion quite credible, since they betoken an almost marvellous size and strength.

They can imitate almost any kind of action, and have been known to sit at table, to use a knife and fork, to drink wine, to wear clothes, and to lie in bed with their heads upon a pillow. Still, Mrs. Lee says the natives assured her that these animals, in their wanderings, pick up the fallen tusks of elephants, until they have accumulated a vast burden, which they carry about with them, and at length drop from its pressure, when they die of fatigue; also that when one of their young dies, the mother carries its body in her arms until the bones fall from her grasp by piecemeal.

It appears that these animals attracted the notice of the ancients, who long ago discovered them on the western coast of Africa; for we find in Brown's anecdotes the following quotation from Hanno, a Carthaginian admiral, who paid a visit to these shores 330 years B. C.: "There were many more females than males, all equally covered with hair on all parts of the body. The interpreters called them *gorilbes*. On pursuing them, they could not succeed in taking a single male; they all escaped with astonishing swiftness, and threw stones at us, but we took three females, who defended themselves with so much violence, that we were obliged to kill them; but we brought their skins, stuffed with straw, to Carthage."

Some of these facts, then, are sufficient to show that

these creatures are not devoid of human reason in part, or of something else very much like it. They prove, moreover, that their rationality, of whatever kind it is, excels that of any other animal; or, at any rate, that they are capable of receiving a greater amount of instruction. That feat of detecting the exact degree of heat required in the oven is very remarkable, — indeed, rather astonishing. It implies a considerable amount of the power of observation, as well as of the ability to profit by experience. And no less remarkable is the confirmed fact of their carrying off the negresses, apparently for the sake of their society. This is an act quite unique in the history of brutes. It is totally unlike what any other animal ever does, or ever attempts. No other manifests any disposition to do likewise. We do not pretend to say how far the quality alluded to goes to establish the groundwork of a superior rationality. Neither does it appear, with one exception at least, that any other animal can be taught the etiquette of the table; that is, to that degree of perfection acquired by the ape; nor could any other execute such operations, even though it could be instructed in them. There is, however, every reason to believe that the unwieldy, yet half reasoning elephant, might be trained to perform with its trunk the like actions at table quite as nicely as the monkey, and certainly to do its honours much more abundantly.

There is another peculiarity in the habits of the apes that may be just noticed: it is the use they make of sticks or stones, as circumstances of attack or defence may require. We know of nothing in the animal kingdom, except an instance to be named hereafter, that bears any analogy to it, and it more nearly resembles the human mode of recourse to offensive and defensive weapons. And it must be allowed to be an act indicative of more intelligence than anything else they do. The elephant does nearly the same thing when he makes use of his trunk to draw up water, in order to squirt it upon those he wishes to punish for some acts of misdemeanour committed towards himself. This the elephant has recourse to only as circumstances require; while the larger apes arm themselves with sticks as they travel in

a body, as if they anticipated the foe. Now this certainly seems very much like foresight; but to affirm that it is really such would, in our judgment, be coming to a rather premature conclusion; for if foresight at all, it is quite possible that it may be more of an instinctive than of a rational character. Not much can be said as to the principle of their architecture. Their huts being formed very much after the fashion of the negroes' dwellings, the question arises, since the builders are apeing ones, are the structures imitative, or are they reared by the principle of instinct? If they are perfectly uniform, which is very probable, the latter principle may lay the greater claim to the honour of the architecture.

Notwithstanding the large amount of intelligence displayed in many of the actions of this large ape, the animal which the most nearly resembles man both in organization and form of structure as well as in intellectual capacity, there is not one of its acts that can be said to be the result of an abstract mental quality. There is no positive evidence of a purely abstract mental operation. It cannot be affirmed that its mental faculty, whatever that may be, is capable of performing the functions of mind without the presence of some sensible object, acting as an aid to its memory by the mechanical power of association. There is nothing to warrant the belief that the chimpanzee, or the ourang-outang, can by any effort of will charge its memory to present to it any such thing as the idea of a past event independent of the presence, or the sight, or the touch, or the sound of some material substance with which that event has been previously, and, in most cases, repeatedly associated. Even then it becomes very limited, and the action is performed without a motive as to the consequence; while the knowledge of the operation, like that of other animals, appears to keep pace only with the process. This cannot be called reasoning. It falls infinitely short of it. What mental operation there is, is so weak, that it requires something to support it, for it is neither self-instituted, nor self-sustained. Now the mind of man can think or reason without the presence or sight of any sensible object

whatever. Man can cast his thoughts in any direction. He can reflect upon the past, and meditate upon the future, quite independent of any material body. But the animal mind can do neither. Man has the power to command his memory in an abstract manner. The brute can do no such thing; but it must have something made evident to its external senses.

We will now offer two or three remarks upon those facts, which not only fall far short of giving proof of reason but which are quite conclusive as to its non-possession by the apes. It has been said that these beings pursue no farther when once they see that the piece from which the shot is fired is destroyed. In one form this may go to prove that it is an act produced from a degree of intelligence superior to that of the tiger or the lion, which will not stop at the weapon, as many persons have unhappily experienced to their cost; but nevertheless the act does not prove enough for reason. The wild beasts evidently rush on without the least ability to discriminate between the instrument and the party using it. In a certain sense, however, the apes appear to have a faculty of sufficient power of observation to make such a discernment. But the lion and the tiger do more nearly the work of reason, or that which reason would direct to be done. Yet they do it blindly, for reason is not their guide. They pursue the greater and the living object, without noticing the weapon of attack. But the ape falls upon the instrument only, and his reason does not bring him to the cause of the mischief, but suffers the real object of its vengeance to escape. Here, then, its intelligence is at fault; it is greatly deficient.

And if anything was wanting to prove the utter incompetency of the great ape's intelligent faculty to reason, or even to take one single, simple, and complete step in the process of reasoning, it may be found in a habit that is common to some other brute creatures as well as this one. It seems that whenever the negroes decamp from a wood, where they leave the fires burning, the chimpanzees will approach and sit round them till all the fuel is consumed, and every spark of fire has vanished. Do these beings, then, like the fire, or do they

encircle them merely in imitation of travellers? It is immaterial which of the two forces impels them to the act, for the question is in no way affected by the one more than the other. If they are partial to the warmth of the artificial heat, they would naturally, if they understood it, feed the fire with a supply of fuel. On the other hand, if they surround them merely because they see the negroes do it, they would call upon their imitative faculty for a further effort, and that is, to put the sticks upon the fire in like manner as they had seen it done by the travellers. But they never do this; nor any other animal either. Wood is abundant, and close at hand; their peculiar organization and surprising strength are in every way adapted to seize such fuel and break it to pieces; yet these most intelligent of brutes fail to perceive what is necessary to keep the fire burning. This fact is very remarkable. Why, the large quantity of wood around them and their extreme facility in handling it, present together, one would think, a power of association almost sufficient of itself to suggest the idea to the meanest intellectual capacity; that is, the two materialities almost work out the idea for them. Even then it is missed. Nothing can be more decisive of the absence of the truly rational faculty. Can, then this animal think? Is not the test in this case as simple as possible, and is not the failure as complete as possible? Now we believe that no human savage, however debased by his barbarism, ignorance, and vice, has ever been found who had not discovered the means of lighting a fire, and of sustaining it when lit. But the brute can do neither.

The Ourang-Outang. This large ape has the facial angle rather smaller than that of the chimpanzee; but like the latter, it has the laryngal sac extensive and double. It appears to be native to different parts of Asia, but more particularly to Borneo and Sumatra.

In 1817, Dr. Clarke Abel brought an under-aged ourang to England from Java, and the following are some of the habits of this animal observed by him on the voyage. The ape, in order to be made secure was fastened to a strong staple; but his keeper had no sooner done it, than he unfastened it, and run away with

is chain ; but finding its drag embarrass him, he formed ; into a coil, and threw it over his shoulder. Other ttempts to secure him failed also, and he clung to the opes of the vessel with such pertinacity and power of uscle, that though the sailors sometimes shook them rith the utmost violence, he still retained his hold. At imes he would appear to be playing the pranks of child in anger. When tantalized with an orange, e would give utterance to the most violent shrieks, wing himself furiously about the ropes, and then with iercing screams rush at the side of the vessel, as if with he intention to commit suicide by throwing himself verboard. When off the Cape, the temperature became ow, especially early in the morning ; and the tropical urang, like a true thermometer, indicated the full xtent of the change, by descending from the mast, huddering with cold, and endeavouring to make himself nug in the arms of any one of his friends to derive eat, screaming violently if any attempt was made o remove him. He died at Exeter Change in less than wo years after his arrival in this country.

The climate of Europe, especially that of the northern arts, is much too cold for the ourangs, consequently hey live but a short period when brought into it. In 776, one being conveyed to Holland, was observed, rhen about to lie down on board at the approach of ight, to prepare her bed by shaking well the hay on rhich she slept, and after putting it in proper order, rould wrap herself snugly up in the quilt. In addition o the making of her bed very neatly every day, M. le Huat saw one at Java that was accustomed to bind p her head with a handkerchief before she retired o rest.

The former, on the voyage to Holland, noticed that he padlock of her chain was opened with a key. The pe soon began to practise the manœuvre, by taking up little bit of stick, and after putting it in the key-hole of he lock, endeavoured to open it by turning the stick in ll directions. One morning when on shore she escaped rom her chain, and it was then that the real and beau- iful instinct of the animal displayed itself. This was from he immediate impulse to climb, and accordingly she was

seen ascending with surprising agility the beams and the oblique rafters of a building. Being endowed, like all the species, with extraordinary strength, and capable of prodigious celerity, she was not retaken without some considerable trouble. Though but two feet and a half high, she was nearly a match for the combined strength of four men, who found it necessary to put forth all their efforts in order to secure her. This they effected by two of them seizing her legs, while a third took charge of her head, and the other fastened the collar round her neck. It is no wonder, then, that the full-grown ourang of seven or eight feet in height should prove a formidable adversary to the united force of ten men. During the time of her liberty, she took the cork from a bottle of Malaga wine, and appeared highly gratified with the contents, which she drank to the very last drop, and then put the bottle in its place again.

It is said of Milo, of Crotona, that he saved the life of Pythagoras, his tutor, by his monster strength, but lost his own by an equal amount of folly. He was so strong that he could carry a bullock of four years old upon his back, and he therefore fancied he could tear up a tree by its roots like an elephant, and then break it to pieces. Having accomplished the former, his strength became exhausted in the attempt at the latter; and when the tree was half cleft, Milo allowed his fingers to become pinched in the crevice, at the moment when the reuniting force of the tree was gaining in power over that of his own; and being then held fast, the wild beast came and devoured him.

Now it appears that the instinct of the ourang, in a similar case, imparts to the animal a wisdom superior to that of Milo; for, according to Gemelli Carreri, these creatures sometimes descend from the mountains to the sea-coast, where they find some food in a species of shell-fish, particularly in a large sort of oyster, which they find lying open on the shore. Before putting in their paws, they take the precaution to insert a stone between the shells, to prevent their closing together, and thereby crushing their clutches. They then drag out their prey in safety, and devour it at their leisure.

M. Palavicini, who had two ourangs, male and female,

in his house in Batavia, says, that when any person set his eye intently upon the female, she would throw herself into the arms of her mate, and there conceal her face in his bosom. Of the mate and female taken on board by M. de la Brosse, the former fell sick during the voyage, and submitted to be treated in the manner of a human patient. His disease, being a kind of inflammation, led the surgeon to bleed him twice in the right arm, and ever afterwards the ape, when discovering any return of his indisposition, did not fail to hold out his arm for the pupose of again letting blood.

In Buffon's "Natural History" is the following quotation from Marmot: — "These animals have feet and hands, and, if I may be allowed the expression, a human face, with an appearance of much vivacity and malice. They live upon corn, herbage, and all sorts of fruits; to obtain which they sally forth in large bodies, and plunder the gardens or villages. Before they venture out on this expedition, one of the company ascends an eminence, and surveys the environs. If there is no appearance of any person near, he makes signs to his companions to enter the vineyard or orchard, and begin their plunder; but as soon as the sentinel perceives any body coming, he instantly sets up a loud cry, and the whole company scamper off with the utmost precipitation, and jumping from tree to tree, retreat to the mountains. It is a great curiosity to see these animals retreat, for the females carry four or five young ones upon their backs, and with this heavy load leap with great agility from branch to branch, though great numbers of them are taken, notwithstanding their cunning. When they are angry, they bite; but while they are coaxed they are very tame. Those that are tamed, perform wonders, and imitate mankind in almost all whatever they see them do." In Sumatra, the animal just described is called the pigmy, and being much smaller than the real ourang-outang, is considered by some to be of another species.

As we have the means of knowing how the ourang-outang dies, it will perhaps not be considered irrelevant to our purpose if we allow its description a place here by way of concluding our references to the habits of this

singular animal. The manner of its death is truly affecting, and probably such that no humane person would wish to see a second time. In 1825 a male ourang was killed at Ramboom, on the north-west of Sumatra, by the crew of Captain Cornfoot, and described by Dr. Clarke Abel. But although we have the original description before us, we like the manner in which it is put in the article Mammalia, of the Encyclopædia Britannica, and we shall therefore quote it from that stupendous and matchless work.

"It was upwards of seven feet in height when placed in a standing posture, and measured eight feet when suspended by the neck for the purpose of being skinned. On the spot where he was killed, there were several tall trees, which greatly prolonged the attack; for such was his strength and agility that his pursuers were unable to take a determinate aim, until they had felled all the trees but one. He received numerous balls before he was brought down, and then he lay upon the ground as dead, exhausted by many wounds, with his head resting on his folded arm. It was at this time that an officer attempted to give him the *coup de grace*, by thrusting a spear through his body; but he instantly sprung upon his feet, wrested the weapon from his antagonist, and shivered it in pieces. This was his last effort, yet he lived some time afterwards, and drank, it is said, great quantities of water. He appeared to have travelled from some distance to the place of the "untoward event," for his legs were caked with mud up to the knees. On the reception of each deadly wound he placed his hand over the injured portion, and distressed even his relentless pursuers by the human like agony of his countenance. Indeed, his piteous actions, and great tenacity of life, are said to have rendered the scene altogether highly affecting. At the same time, it seemed odd that so much sentimental perception should have been vouchsafed to those who committed the onslaught, and who were under no absolute necessity of bringing the business to so tragical a close."

There is, then, nothing either in the instincts or in the intelligent habits of these animals to call for any particular remark in addition to what we have already

made upon those of the chimpanzee. We may, however, just notice the remarkable instinct displayed by the young of both. It is an instinct exactly similar to that with which the young of many other animals are endowed, the instinct of self-preservation. On the moment of alarm the little apes spring upon their mother's body, and grasp it with such tenacity that no jerk can possibly loosen their hold, for the female parent, notwithstanding her burden, makes her usual and often surprising leaps of twenty or thirty feet from branch to branch, and from tree to tree, without finding it necessary to give any assistance to her offspring by way of supporting it upon her own body. Each little one holds fast, quite fearless of a fall, and doubtless without knowing anything as to the cause of its being carried off in such a hasty manner, or as to the consequence of insecurity, or of a tumble; for if these creatures resemble the young of some others we have seen in a similar situation, of which there is every probability, they will appear in one moment after as innocently unconcerned as ever.

Now these are not the characteristics of a child, as every intelligent observer of children must be aware. It is true that the infant of a certain age will cling in a certain manner round its parent for refuge against danger. But this is when the child is capable of discovering the approach of danger, be it real or imaginary, for itself, and not by having it communicated to it, as is the case with animals. Sometimes a child, when on the precipice of some imminent peril that it does not itself perceive, but which its mother does see, and although she calls with all the earnestness of terror, the child, instead of rendering a prompt obedience to the alarm she sounds, and of effecting its escape with celerity, remains motionless, and often till the catastrophe overtakes it. But the moment the mother of a young animal gives the alarm, or a command for her offspring to make their escape or take refuge, their obedience is implicit and instantaneous, and rendered in a manner that is peculiar to all the species. How animals communicate the alarm so as to be understood by their young, is a question upon which we shall speak in another place.

The Gibbons.—These animals are natives of the forests

of India and the Asiatic islands. They are much smaller than the great ourang, and very remarkable for the expertness of their arboreal exercises. Their motion through the trees is so rapid, and their touch on the branches so light, momentary, and easy, that their progress is said to resemble an aerial flight; and it has been observed that they have been seen to launch themselves over a distance of forty feet that has intervened between one branch and another, their whole body seeming suspended in the air by their long and extended arms alone.

All the apes of this genus possess large powers of imitation, and their propensity to indulge in such often betrays them into trouble, which sometimes terminates in capture, and sometimes in death. Ever watchful and attentive to all the actions of man, they descend from their posts of observation, and then endeavour to imitate as near as possible all they have seen performed. The ape-catchers take advantage of this propensity, and in some instances place a vessel of water in a situation that is open to the view of the animals perched upon the trees. The men take care to dabble well in the vessel, and to wash their hands, particularly their faces, with a great deal of attention, that they may set a copy worthy of the brutes' ambition to do the like. All this being done, the water is poured out, and its place supplied with a solution of glue. The article is left for the inspection of the meddling mimics, which never fail, unless they have been previously caught, to handle and apply it in the manner their entrappers were observed to handle and apply the water. Unwarily they set to in good earnest, bedaubing their faces with the treacherous liquid, and soon their eye-lids become glued over the sockets, and being thus blindfolded, they cannot effect escape from want of sight, and they then present an easy prey to their captors.

Another mode of ensnaring them is by means of intoxicating drinks. The apes being known to be fond of spirituous liquors, the person who wishes to secure any of them places a number of vessels filled with ardent spirits within their sight and reach, and after a pretence to drink he retires to a distance, where he can behold

the novel spectacle of animals holding a feast to Bacchus. They drink; the spirit takes effect; the apes fall asleep, and, like man in the same circumstances, become the victims of their own folly.

It is said that the Indians sometimes direct their imitating propensity to useful purposes; for wishing to collect the cocoa-nuts and other fruits from the trees in the woods frequented by the apes, they repair to these places, setting the example of gathering a few heaps first themselves, and then, withdrawing, leave the work to be performed by the animals at will. These creatures, seeing a heap or two commenced, descend with the certainty of carrying on the business, and when the produce has been thus rather plentifully collected, the Indians approach and take away the harvest.

M. de Maisoupré was once a witness of a single male ape of a larger species finding his way within the walls surrounding the pagoda of Cheringham, which enclosed a district claimed by the community of a smaller species; for it appears that certain herds of them live together in this way, and assert their rights to the possession of particular provinces, and if necessary will take up arms to defend them. The trespasser was very quickly made to understand that he had got into an enemy's country. The alarm cry being given, numbers of the resident males put themselves in a posture of attack. Though the interloper was much larger and stronger than any of his assailants, he yet seemed to be aware that the contest would be unequal on a fair field, for he betook himself to a stratagem, and fled for an advantageous position on the top of the pagoda, which was eleven stories in height, and when faced about on the pinnacle of it, he saw a number of his enemies in force at his heels. His sagacity and generalship now proved the means of his safety. Being himself secure upon a narrow dome, he, taking advantage of his superior personal strength, instantly seized four of his furious pursuers, and as furiously hurled them down from the dizzy top. This exploit was sufficient to warn and to intimidate the rest, and after a great deal of noisy clamour, they resolved upon a retreat, which they effected in

safety, leaving the intruder unrevenged upon his perch. Here he took care to remain till the evening, when he was able to get clear off.

According to M. d'Obsonville, the female apes manifest a considerable degree of tenderness towards their offspring; and, what is very remarkable, they exercise, sometimes at least, their parental authority in a sort of judicial and strictly impartial form. The young ones were seen to sport and gambol with one another in the presence of their mother, who sat ready to give judgment and punish misdemeanours. When any one was found guilty of foul play or malicious conduct towards another of the family, the parent interfered by seizing the young criminal by the tail, which she held fast with one of her paws till she boxed its ears with the other. Now we do not know of anything exactly similar to this in any other tribe of animals. The proper performance of such an act most certainly implies a very considerable amount of understanding. There is another habit, too, peculiar to these creatures, that, if true, requires no less intelligence than the one just named. It is said that when any one of them receives a wound by an arrow, the whole community fly to its assistance; but instead of pulling out the missile, which by so doing would lacerate the flesh and give pain, they bite off the shaft only, and thus allow the unfortunate animal to go off with the remainder in its body. It is also affirmed of the baboons that they will nip off the sting of a scorpion with so much dexterity and rapidity that they leave no time for the venomous weapon to produce any effect upon their hands, and that being done, the apes devour the scorpions with much greediness.

The baboons are the most ferocious and the most disgusting in manners and appearance of the monkey tribe. Their strength from muscular energy is very great, and when put fully forth is sufficient of itself to tear the strongest dog to pieces in the short space of a few minutes. Goldsmith says that these animals, "mixing the figure of the man and the quadruped in their conformation, seem to possess only the defects of both; the petulance of the one, and the ferocity of the other." The natives dread them, for they will plunder their vil-

lages, rob their orchards, and retire leisurely with the booty. Sometimes they appear to do the latter business by method. A sentinel is appointed to watch, while a part of the company enter the enclosure, and a part remain without; the latter form a line to the place of depôt, and the former gather the fruit. If the wall is high, a small force takes station upon it, and these, after receiving the produce from those within, throw it to those in line without. It is then passed along the line to its hiding-place, which is generally in some crag of a mountain.

Le Vaillant, when making his tour through the southern part of Africa, kept in his possession a dog-faced baboon, to which he gave the name of Kees. He made use of the inquisitive propensity of his ape for the purpose of tasting strange or unknown roots or fruits. Kees would taste all without scruple, and those he rejected were supposed to be either of a disagreeable flavour or of a pernicious quality. But whenever the animal met with any favourite root, he was always anxious to secure it for himself, and stemming the ground with his fore feet, he grasped the plant with his teeth, and pulled out its root by main force. Sometimes, however, his strength applied in this form was not sufficient for the purpose, and then he would have recourse to the expedient of still holding the herbage in his teeth close to the ground, and throwing himself quite over, thus making his body act as a sort of lever, and this mode seldom ever failed to bring up the root.

Kees was fond of newly-laid eggs; and in order to deprive him of his feast and secure the eggs, a dog was trained to run to the nest immediately the hen was heard to cackle, and bring away the egg before the thief had got possession of it. Occasionally the ape would run too, and being the stronger animal, he in these cases often obtained the mastery, and carried off the prize.

The imitating propensity in all the monkey tribe is a very curious thing. It must be the result of a very remarkable instinct, for it is neither an acquired habit, nor anything obtained by instruction, nor is it gathered by experience. It seems to have no motive either. It is

quite clear that the apes do not exercise it for the sake of the fun afforded by mimicry. Such sport is as remote from their understanding as is the motive; for they always appear serious, if not melancholy, even while engaged in the very act. Still it may be productive of some kind of pleasure to them, and very probably it is; but it never seems to put them in a state of ecstacy or great hilarity. Now when man has recourse to mimicry, it is either for the purpose of exhibiting the most profound contempt, or of exciting to laughter. Whether this instinctive faculty in monkeys can be or ever was intended to be directed to any useful purpose, is perhaps a question that cannot, at present at least, be very satisfactorily answered. It is sufficient for us to believe that the Creator has made nothing in vain, and that all His works are done in wisdom.

The case of the Barbary ape and the preacher, Caubassan, related by Mrs. Loudon, is perhaps an instance of imitation as ludicrous as anything of the kind that has ever been witnessed. Father Caubassan brought up the animal in question, and having become attached to him, it wished to follow him wherever he went. One day when Caubassan was going to church, the ape, not being made secure, followed its master to the place of public worship, and being a good climber, silently mounted the sounding-board, and there lay quiet and concealed till the sermon was in course of delivery. It then advanced to the edge of its perch, to see what was going on beneath it, and to watch the actions of the orator. These were no sooner observed by the able mimic, than it began to perform also; and its imitation of the preacher's gestures was so perfect and grotesque that the whole congregation was put into a state of great risibility, and such that could not be suppressed. The good father was alike shocked and indignant at the ill-timed levity of his audience, and began to minister some severe reproofs. But seeing all his efforts failing, he launched forth into violent action, accompanied by loud vociferations. His frequent gestures the ape did not fail to take up immediately with no less animation than that which inspirited his master; and at this apparent competition of the two individuals, the people burst into

roars of laughter, and when the animal was pointed out to the pastor, though highly exasperated, it is said that he could scarcely command his own countenance while he gave directions to have the ape removed.

We quote the following instance of the imitating powers of the baboon from Brown's Anecdotes of Animals: "The army of Alexander the Great marched in complete battle array into a country inhabited by great numbers of baboons, and encamped there for the night. The next morning, when the army was about to proceed on its march, the soldiers saw, at some distance, an enormous number of baboons, drawn up in rank and file, like a small army, with such regularity, that the Macedonians, who could have no idea of such a manœuvre, imagined at first that it was the enemy drawn up to receive them."

Monkeys.—The species of the genus Saguinus, have comparatively a large cranium, and exhibit a corresponding amount of intelligence. Fruits and insects form their food, and the equatorial forests of the new world are the places of their abode. Their habits are gregarious; and their tails being destitute of the prehensile character, they frequently resort to the denser brushwood, or to the escarpments of the rocky banks of rivers. With a rounded head, a rather flat visage, and an expression of innocency, their physiognomy bears a resemblance to that of the human infant, and though they are ever in motion, all their movements are said to be full of grace. Humboldt was considerably amused by seeing one of these animals, of the species Sciareus, squirrel monkey, endeavouring to single out a spider among some engravings on paper, and to pick it off with its paws. The play of its instinct made the same efforts to take the insect that it would have done had there been a living spider within its grasp instead of a picture. Their instinctive adroitness, made manifest in the capturing of insects, is very marvellous, and might, it is supposed, be brought under the controul of the entomological collector. It is through the instinct of affection that their young are taken, since they refuse to abandon the mothers when bleeding and dying from wounds.

One species of the Saki, or fox-tailed monkeys, have a very singular habit in the mode of taking their drink. It is called the hand-drinking monkey, because it takes the water in the hollow of its hand, and after putting his head on one side, the careful creature then conveys the liquor to its mouth. This peculiar mode of taking beverage appears to be necessary in order to avoid wetting its long tufted beard; but its adoption cannot be said to be the result of the animal's sagacity, for intelligence does not produce a uniform mode of acting in all the individuals, whereas instinct does; it is therefore more in accordance with analogy to refer it to an instinct, and a very remarkable one it is. Why its instinctive aversion to the wetting its beard is not known. No doubt a cause exists somewhere, though its spring is concealed from man's gaze, for the animal becomes furious when any water accidentally or otherwise runs down its precious beard.

The monkey of the Jacchus genus, or Onistitis, is a truly remarkable creature, and has some extremely curious habits or instincts. Crickets and cockchafers are great luxuries to it, and it darts upon these insects, and devours them with much apparent greediness. Its manner of capturing all kinds of flies is wonderfully dexterous; and though it seizes upon them so instantaneously, and without any apparent discrimination, it will yet recoil with instinctive and agitating fear from the attempt to clutch a wasp. M. Audouin of Paris, who had a pair of these animals for some time in his possession, was satisfied that this fear was the result of an instinctive faculty, and not of experience, for the French species of wasp was quite different from any these monkeys could have ever seen before. They would, too, dart at the representation of insects in paintings, but would immediately withdraw their paws from that of a wasp, while that of a cat exceedingly alarmed them. These creatures could recognise themselves in a glass as well as others of their own species. Now this is a power of perception beyond that of the dog. Though they exhibited no fondness for flesh, they would yet capture a bird, and after putting it to death, do nothing more than scoop out its brains. Why they should do

this only, gives rise to a very curious question as to its cause, and one that is enveloped in much mystery, and probably will remain so.

Of one species, which Buffon calls *ouarine*, "I have frequently," says Margrave, "been a witness of their assemblies and deliberations. Every day, both morning and evening, the ouarines assemble in the woods to receive instructions. When all come together, one among the number takes the highest place on a tree, and makes a signal with his hand to the rest to sit round, in order to hearken. As soon as he sees them placed, he begins his discourse with so loud a voice, and yet in a manner so precipitate, that, to hear him at a distance, one would think the whole company were crying out at the same time; however, during that time, one only is speaking, and all the rest observe the most profound silence. When this has done, he makes a sign with the hand for the rest to reply; and at that instant they raise their voices together, until by another signal of the hand they are enjoined silence. This they as readily obey; till at last the whole assembly break up, after bearing a repetition of the same preachment."

If such is a correct representation of the monkey school, it affords an example of propriety and order that might be profitably imitated by the debating societies and the legislative assemblies of all the nations of the world. That is certainly a most marvellous instinct, which gathers the assembly by the no less marvellously instinctive command of an individual of the species. What the subject of the lecture is, and what its object, are both unknown; but they start some curious speculations in the mind of the philosopher. Whether the lecturer must possess certain qualifications before he can have the appointment, or whether he receive the appointment by election or otherwise, are matters that are unknown also.

It has been said that the monkeys manifest much parental tenderness towards their young, as well as much concern for their future welfare; that they seem to labour with great assiduity to instruct them, and even to apply the rod of correction when they observe any want of aptness to learn, or any disinclination to profit by the

example set them. The male and female take their turn in this duty, and hand their little ones from one to the other, as occasion or convenience may serve. Though we read of the eagle teaching her young to fly and to mount aloft in the air, yet to instruct is not a characteristic of animals, and such a feature in the habits of the monkey is all the more striking and peculiar. The very attempt to teach seems to imply the presence of some superior intelligence; but we believe this case, and others like it, proves too much, and requires such a process of abstract reasoning that is not accorded to animals; and we see no reason why it should not be ascribed to a faculty of instinct; nor do we know why instinct should not direct its functions to such a purpose as well as to various others quite as indicative of reason.

We apply the same remarks to that singular and well-known habit some species of monkeys have of devising an expedient to reach a branch of a contiguous tree that is too far distant for their ordinary leap. One suspends itself from an upper branch; then the rest of the family form a chain with the first by locking tail in tail, or hand in hand; this being done, the whole string of monkeys is thrown into a swinging motion like that taken by a pendulum, until the undermost one is able to seize hold of some branch on the opposite tree, when the one above, which sustains the weight of the whole, lets go its hold, and reverses its position; for it sinks down to the bottom, though maintaining its grasp, and it is then the first to creep up the chain to gain the branches that could not have otherwise been reached.

Now the following questions,—questions more easily put than answered,— arise out of this remarkable operation. What, in the first place, directs these animals to the expedient at all? How do they know one another's intention as to the act itself, and the moment of entering upon it? How do they, being destitute of speech, communicate their meaning to each other? How does the uppermost one of the chain know when to let go its hold? How is it that it does not, sometimes at least, make a mistake by being too precipitate, and thereby letting all the chain fall to the ground? And all that

an be said to them is, that they are the curious operaions of that marvellous faculty in animals called instinct, nd not, we apprehend, the products of purely rational owers.

In the *Oriental Annual*, 1836, there is a remarkable eat of a species of monkey, which Buffon terms the Talapoin, recorded as an instance of that animal's sa;acity. The exploit was performed by one which had een tamed by a native of Hindoostan. He was chained o a pole of thirty feet in height, and in such a manner hat he could ascend or descend the bamboo pole at will, or his chain was fixed to an iron ring that encircled he pole, and slipped up and down with the ascent and escent of the animal himself. When perched upon his ofty seat, and gazing upon the fine prospect around him, he crows of India, which are noted for their audacity, ften pounced upon his food at the bottom, and carried t off. This robbery was frequently repeated, and nohing the monkey could do was sufficient to scare them way.

"One morning, when his tormentors had been parıcularly troublesome, he appeared as if seriously inisposed; he closed his eyes, drooped his head, and xhibited various other symptoms of severe suffering. No sooner were his ordinary rations placed at the foot f the bamboo, than the crows, watching their opporunity, descended in great numbers, and, according to heir usual practice, began to demolish his provisions. The monkey began to slide down the pole by slow egrees, as if the effort were painful to him, and as if o overcome by indisposition that his remaining strength ras scarcely equal to such exertion. When he reached he ground, he rolled about for some time, seeming in reat agony, until he found himself close by the vessel mployed to contain his food, which the crows had by his time well nigh devoured. There was still, however, ome remaining, which a solitary bird, emboldened by he apparent indisposition of the monkey, advanced to eize. The wily creature was at this time lying in a tate of apparent insensibility at the foot of the pole, nd close by the pan. The moment the crow stretched ut its head, and ere it could secure a mouthful of the

interdicted food, the watchful avenger seized the depredator by the neck with the rapidity of thought, and secured it from doing further mischief.

"He now began to chatter and grin with every expression of gratified triumph, while the crows flew around, cawing in boisterous chime, as if deprecating the chastisement about to be inflicted upon their captive companion. The monkey continued for awhile to chatter and grin in triumphant mockery of their distress; he then deliberately placed the captive crow between his knees, and began to pluck it with the most humourous gravity. When he had completely stripped it, except the large feathers in the pinions and tail, he flung it into the air as high as his strength would permit, and after flapping its wings for a few seconds, it fell on the ground with a stunning shock. The other crows which had been fortunate enough to escape a similar castigation now surrounded it, and immediately pecked it to death. The expression of joy on the animal's countenance was altogether indescribable; and he had no sooner seen the ample retribution dealt to the purloiner of his repast than he ascended the bamboo to enjoy a quiet repose."

If this account of the feigning operations of the animal is a faithful and unexaggerated description of the real facts, it then bears testimony to the presence of some thinking powers. We must confess, however, it does a little tax our credulity. Many observers of matters of this kind, that is, of things that are a little marvellous because uncommon, have a tendency to give too much rein to their imaginations; not wilfully perhaps always, but often thoughtlessly, or from a vain desire of raising an excitement, and drawing the attention of others through themselves to an object that cannot fail to be regarded as a wonder. So that in a great many cases the one or the other of these motives prevails, whether in writing or speaking, and hence, we believe, a very great gloss is often put upon the representations of any of Nature's extraordinary phenomena, till the original and the copy become so wide apart that it is quite impossible to recognise the principal points of likeness. In the case before us, the monkey must have been conscious of a purpose when he so artfully feigned illness; and that

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r did the monkey know that the crows would be
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hich we have already noticed. Yet no animal, not
he chimpanzee, or the ourang-outang, has been
to do that simple thing, although association has
outed all its power, and inducement all its force.
is fact be ever borne in mind, it is conclusive. The
gent faculty is so flexible and accommodating, that
animal could reason on one thing, it could do the
another. Reason is, moreover, progressive, but the
stands still. No doubt there have been witnessed
extraordinary feats of animals that have apparently
from the seat of intelligence, but have been in
the workings of a hidden instinct. Our belief is,
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the beholder.

the point to which our special attention must be
ed is, that whenever these singular creatures

happen to repass the object of their late inspection, no matter how recently, they will survey it again in the same manner as before, and this as often as they come upon it, without apparently being able to recognise the same object, and without seeming to have the least remembrance of having seen, or of having examined it just previously.

Mrs. Lee, too, mentions of the monkey on board the vessel with herself, that Jack, for such was his name, would sometimes scald or burn his fingers, by snatching out the herbs from the hot beverage; the pain would keep him quiet for a few days, but no sooner had it been alleviated than Jack repeated his tricks, and again suffered the penalty. Was this owing to any absence of memory in the monkey, or did he, like mankind, too often commit the deed right in the face of the consequence? No doubt that man does this injustice to himself much more often than does any brute whatever. He will gratify some sensual appetite for a moment, although he knows full well that the pain which will certainly follow will be neither light nor short. The probability is, that Jack's knowledge of the past ceased with the pain; at least we should judge so from analogy, because those animals which appear to have a memory active, when assisted by the power of association, are not found to be so easily taken in when that is present. This kind of memory, although exceedingly imperfect, is nevertheless sufficient to enable them to profit by experience.

Yet the same authoress informs us of another in the Jardin des Plantes, in Paris, that she very much annoyed by striking him on his paws for some misbehaviour towards one of his companions, and that this monkey seemed ever afterwards to recollect the treatment, when, at least, the associating power of her presence came to the aid of his memory; for on future occasions, he no sooner saw her, or heard her voice, than he threw himself into a passion, rolled about in rage, and in one instance seized her gown, and dragged a portion of it within the bars of his cage, where he then tore a piece out of it, although it was made of some stout material.

As an instance of the monkey's apparent gravity, even

in the midst of frolic, Mrs. Lee tells an amusing story of some pigs that were allowed to run about the deck occasionally, and Jack would then sometimes "suddenly spring on the back of one of them, his face to the tail, and away scampered his frightened steed. Sometimes an obstacle would impede the gallop, and then Jack, loosening the hold which he had acquired by digging his nails into the skin of the pig, industriously tried to uncurl its tail, and if he were saluted by a laugh from some one near by, he would look up with an assumed air of wonder, as much as to say, What can you find to laugh at?" So that which is so touching to man's sensibility has no power to excite any risible faculty in the animal, because there is none. The brute has no such perceptive mental powers.

CHAP. VIII.

Elephant. — Musical Faculty. — His Brain. — Sagacity. — Attack on Tiger. — His Instinct curious.

On surveying an elephant, one is struck with the massive structure and ponderous body of the beast. With the enormous weight of about seven thousand pounds, a large individual moves through a forest of trees with the certainty of a powerful locomotive engine, scarcely allowing an obstacle either to turn from his course or to impede his speed. If the huge proportions of the animal astonish and interest the spectator, the amount of food he requires for his daily consumption is enough to astound, if not to affright his proprietor. We take the following interesting paragraph from the Encyclopædia Britannica:—

"Elephants in this country are usually fed on hay and carrots, and the quantity of food which they consume is enormous. Those of the emperor Akbar had each a daily allowance of 200 lbs. in weight, with an additional supply of ten pounds of sugar, besides rice, milk, and pepper, and during the sugar cane season each was provided daily with 300 canes. The Mogul princes

are known to have kept up their stud of elephants at a vast expense; and according to Pliny, even the Romans, a people so addicted to extravagance, found the sustaining of the Carthaginian elephants captured by Metellus so costly, that they were afterwards slain in the circus. Yet, according to Æolian's account, less rigid economy prevailed in the days of Germanicus. His elephants were exhibited in the arena, reposing on splendid couches, adorned with the richest tapestry. Tables of ivory and cedar wood were placed before them, and on these their viands were presented in vessels of gold and silver. They danced to the sound of "flutes and soft recorders," or moved about the theatre in measured and harmonious steps, scattering around them the freshest and the choicest flowers. Arrian mentions an elephant which played on cymbals, one being fastened to each knee, and another held by his proboscis, while his unwilling companions danced in a circle, keeping time with the greatest exactness."

Has, then, the elephant any kind of instinctive musical faculty? If so, it is not improbable, considering the well-known intelligence of this animal, that such an endowment might be educated. It has always appeared to us that the musical faculty possessed by man, by some more than others, is at least to a certain degree instinctive; for we are slow to believe that that rapid motion of the fingers, yet composed of a mixture of many simultaneous strokes, and of many in succession, and so that all the touches are made to the least fraction of a moment, which a dexterous and accomplished player can put into execution upon the piano, is an art or habit altogether attainable by education and practice. We do not think that all these rapid and complicated touches proceed from the volitions of a will under the controul of reason simply. The intelligent faculty must be aided here by an instinctive impulse. We have often looked upon the perfection of the art as a wonder; it never fails to arrest our attention and excite our highest admiration; but the operations of the mental powers merely, though in connection with the power of habit acquired by long practice, do seem to us insufficient to account for it. Admitting instinct to have a share in

the performance, the thing becomes more explicable, though the instinct itself, like every other instinct, is mysterious.

Our conclusion is, that the musical faculty in man is partly an instinctive power, or impulse, the manifestation of which its possessor can hardly suppress; for in those persons, moreover, who have it in great strength, it is perfection itself, though not acquired, and before instruction has been brought to bear upon it. But whether animals possess the same kind of faculty, or anything corresponding to it, may perhaps be a matter of question. It is true that many are sensitive to the charms of music, but in what way we do not attempt to explain.

Sir E. Home made an experiment upon a full grown elephant in London, and found that the grave notes of the piano produced an apparently pleasing effect upon the animal, for he put forward his large external ear, as if in the act of listening, and of endeavouring to discover from whence the sounds proceeded. A similar one was made at Paris in 1798, and was attended with results somewhat more effectual. A lively national air had the greatest effect, and wrought up the elephants, male and female, to a degree of very curious excitement.

Phrenologically speaking, the elephant has a magnificent cranium, and in appearance very nobly developed; but when the organ of intelligence is sought for within, with an expectation of finding something equally grand there also, the philosopher, who looks with hope, has that hope disappointed; for the cavity of the organ is comparatively very small, and the cerebral matter is not more weighty than that to be found in the head of man, whose bulk is comparatively so insignificant. Still, for an animal, the elephant has a large quantity of this mysteriously working matter; and, notwithstanding the great authority of Baron Cuvier, who says, that after a long study devoted to elephants, he could not find that their intelligence surpassed that of the dog or that of many others, we think, on the contrary, that its sagacity stands unrivalled by any other inferior creature whatever, at any rate for its grace and nobleness. This huge beast becomes so docile and gentle that he may be trusted to the utmost; so harmless and free from stealth, that,

unlike the tiger and the leopard, or even the lion, he is never suspected; but if his majestic ire be once unjustly provoked, he will not fail, if possible, to retaliate with the most condign retribution, and his gigantic strength makes his revenge quite fearful, for it is then even vindictive. There are so many anecdotes of this animal's execution of the most rigid justice by making the culprit feel the weight of his vengeance, and so many instances of his sagacity likewise, put upon record in almost all books of natural history, that it is unnecessary to introduce any here; nor, were we so inclined, would our space admit of it. But one instance of the latter, most nobly displayed, shall have a place.

The favourite elephant of the grand vizier under Rajah Dowlah was the hero of the noble feat. This great nabob was about to make the diversion of a mighty hunt in the neighbourhood of Lucknow, where the game was rather plentiful. The preparations being completed, and a train of Indian nobility assembled, the procession of Nimrods began to move off for the field. After passing through a ravine, the gorgeous sportsmen entered a meadow, which was covered with sick people, who were lying exposed to get the benefit of the pure and fresh air, and they were so distributed as to obstruct the course of the beasts of burden. Rajah Dowlah was intent upon feasting his cruel eyes with the sight that the mangling of the bodies of the miserable creatures would produce, by compelling the huge elephants to trample them under foot.

The grand vizier rode upon his own beast, and the nabob ordered the driver to goad him on, and he went at a quick pace; but when he arrived at the spot of the indisposed people, though in a trot, the sagacious animal stopped short before the first invalid. The vizier cursed him; the driver goaded him; and the nabob cried, "stick him in the ear." All, however, was vain. More humane than his superiors, the elephant stood firm, and refused to violate his better feelings. At length, seeing the poor creatures helpless and unable to move themselves out of his way, he took up the first with his trunk and laid him gently down again out of his path. He did the same with the second, and third, and so on, until he had

lear passage, along which the retinue could pass
doing injury to any one of them. The brute
man had made an exchange of their proper sen-
and humanity triumphed gloriously in the
We question whether another instance of such
nd humane sagacity can be produced from any
ı the animal kingdom.
lephant, however, with all his docility, tract-
and sagacity, could not be trained so as to be
ıt all times in battle. The ancients used him
r this purpose, and when he could be guided
he was found a mighty engine of destruction;
ı wounded, especially if his trunk was lacerated,
l under his irritation turn upon his own ranks,
e horrible carnage of his friends. The Romans,
[etellus, galled the Punic elephants by pouring
of darts upon their sensitive trunks, and the
becoming infuriated and unmanageable, threw
can troops into confusion, and the Carthaginian
ıs then easily defeated. The elephant, then,
well trained, and well trained he often was,
ever firmly attached to his patrons, could not be
understand that an enemy inflicted the wounds
vrought him up to such ungovernable rage.
cted as if he believed that treason was in the
ıd unlike rational beings at such a crisis. He
then, and cannot reason.
› there is the presence of the intelligent ele-
here the reasoning faculty, like a superior,
ppears to claim the priority in operating; hence
cases the power of instinct, though present, is
l, and the functions thereof are held in abey-
n so sagacious an animal, therefore, as is the ele-
he latter will not be expected to display itself
ıuently, nor very powerfully.
here are some habits of the elephant that must
ɔuted to the workings of an instinct; for in-
he animal seems to be instinctively conscious of
ırtance of the part his trunk is required to play
ɔnomy of his life; and he is accordingly ever
over its safety. He sets a strict guard upon
; a dangerous crisis, and takes the utmost care

that it shall not be exposed to peril. When provoked to take vengeance on man, he does not scruple to seize him with his trunk, but never employs that member to grapple with a tiger, nor to hurl him in the air with it. He scents the tiger's lair at a distance, and instantly throws his trunk high up, so that it may be as far as possible from the reach or spring of his stealthy adversary. The unwieldy animal manifests great uneasiness, and proceeds with extreme caution, as if conscious that his enemy would be upon him unawares. When at length the fierce feline has taken his leap of attack, and the furious struggle commenced, the elephant endeavours, though not with his trunk, to bring his antagonist under his enormous feet, which attempt, if successful, crushes him instantly, or if he can get an opportunity of dashing at the tiger with his tusks, he tosses him, like a ball, to an immense distance, and does him severe injury by the shock. But his favourite mode of attack is the pitch, whereby, with the certainty of killing his adversary, he transfixes and pins him to the ground with his tusks; for here the whole weight of the animal is brought to bear in the dreadful plunge; and either by sagacity or instinct, the latter we should say, the elephant is made fully aware of this force, and of the advantage it gives him.

So much does the elephant dread the consequence of the wild beast's attack upon his most powerful yet most delicate proboscis, that he will throw it out of reach even when a dead tiger is brought in his presence. The following account is given of the poor beast that was burned at Dublin, and is an illustration of a strong instinctive consciousness of the value of his trunk:— "Doubtless the elephant's care to preserve the proboscis was great; for when we dissected him, we found it thrust near two feet into the very ground, upon which account we thought it had been burned, till the head was divided from the body, and then we found it kept fast to the ground by the proboscis."

If, after considering the importance of the trunk, we knew the elephant to be possessed of reason, we should then no longer feel any surprise at the extreme care he takes of that serviceable member of his body. This

curious organ is so admirably constructed that it serves purposes as innumerable as they are infinitely various. It is composed of nearly 40,000 small muscles, collected into small bundles, and so interlaced with one another as to produce every diversity of motion. It blends in a very remarkable manner the strength of a giant with the most exquisite touch of a tentaculum. At one moment it can lift a cannon from the ground, or tear up a tree by its roots; and at another, pick up a small pin from the dust of the earth. It collects the food into his enormous mouth, and drives the water down his capacious throat; hence the life of the beast is dependent upon the preservation of this curious structure. How does the animal know this? Certainly not by experience; nor probably by sagacity. Instinct must be his teacher.

The elephant manifests also a most marvellous instinct in relation to the great weight of his body. He seems to have a kind of knowledge that his ponderous mass is of unusual and extraordinary heaviness; for when he is required to pass over an unsafe bridge, or other artificial road, he suspects the danger with wonderful prescience, although man is unable to detect any defect in the structure. In one of the Indian expeditions, an artificial road, formed by the trunks of trees, was made on a difficult ascent, up which it was designed each elephant should drag a gun.

"Having cut a good deal of the most promiment part of the hill away, and laid trees on the ascent as a footing for the elephants, these animals were made to approach it, which the first did with some reluctance and fear. He looked up, shook his head, and when forced by his driver, roared piteously. There can be no question, in my opinion, that this sagacious animal was competent instinctively to judge of the practicability of the artificial flight of steps thus constructed; for the moment some little alteration was made, he then seemed willing to approach. He commenced his examination and scrutiny by pressing with his trunk the trees that had been thrown across, and after this he put his fore leg on with great caution, raising the fore part of his body so as to throw its weight on the tree. This done, he seemed satisfied as to its stability. The next step

for him to ascend by was a projecting rock which we could not remove: the same sagacious examinations took place, the elephant keeping his flat side close to the bank, and leaning against it. The nexts tep was against a tree; but this, on the first pressure of his trunk, he did not like. . . . Force was at length resorted to, and the elephant roared terrifically, but would not move; something was then removed, he seemed satisfied as before, and he ascended that stupendous ghaut."

The female elephant, only seven years old, that was taken to the Adelphi to repeat some parts she had performed in Paris, likewise carefully ascertained the safety of the stage before she ventured her whole weight upon it.

There is another habit of elephants which is proper to our subject, and which, therefore, we shall just notice. It is the understanding they have, or the arrangement they make, when a whole herd, amounting sometimes to 300, is on its march to open a new track through a dense forest of trees. The large male elephants always put themselves in the van, and proceed in some cases to tear down the branches, and in others to uproot the trees which obstruct the passage, that a way may be cleared for the females and those of youth and weakness, which follow in the wake in a single file. How do all come to this mutual understanding? How do the tall and strong individuals know that it becomes them to undertake the most difficult task in the operation? Do they assume it instinctively, and the others instinctively assent to it? Or is the arrangement come to by appointment? The secret, no doubt, lies in an instinct.

CHAP. IX.

The Dog. — His Endowment. — Peculiarities of the Greyhound. — Of the Bull-Dog. — An Exploit. — An Impulse. — The Blood-hound extraordinary. — Murderers taken. — Pointer. — His curious Instinct. — His remarkable Attitude. — The Hound's Instinct. — The Wild Dog's. — Animal's Weapons. — How used. — Fox. — His Artifices. — Instinct of Kittens and Cubs. — Fox feigning Death. — His Tricks. — Guided by Instinct or Mind? — Instinct accommodating.

THOUGH the dog is so universal and common, he does, nevertheless, from a combination of causes in his habits, present volumes of the most interesting study to every admirer of nature's wonders. His social disposition, unlike that of most other animals, is more directed to human society than towards that of his own species; at least, where he has man to associate with. In the intimacy of this association with the lord of creation, he stands alone, even surpassing in every way that of the domestic cat. His knowledge of his master or his friends is thorough, ready, and decisive; while his attachment is sincere, firm, and enduring. He remembers a caress or a kindness, and forgets an injury from his friends. He is quick to perceive the approach of a stranger, and his watchfulness and suspicion are instantly awakened. His fidelity is so stable that no vicissitude or circumstance ever shakes it. He will risk his life to save that of his protector, and die rather than relinquish his post of duty. He is capable of intense emotion, for it has happened that the unexpected joy of meeting a long absent friend has burst his very heart asunder, and he has expired at the feet of a former and indulgent master. All these are qualities peculiar to himself, and distinguish him above any other tribe of animals. Yet how often do we see this amiable creature ill used by ignorant and cruel men or boys. Sometimes he is unmercifully beaten because he is a brute, and cannot understand all that is expressed in the commands given to him, and sometimes he is re-

quired to suffer much through the capricious and irrational temper of his owner.

The dog is remarkable for one physical property of exquisite delicacy, and that lies in the fineness of his olfactory nerve, by which he scents his game with unerring certainty. Nevertheless some birds of prey exhibit a power of scent more astonishing than his, because it is even more refined. But the dog has some mental endowments that perplex the philosopher infinitely more than that wonderful sense of smell we have just named; for they are such that make him appear to live, as expressed by Professor Harwood, "in the doubtful confines of the material and spiritual worlds."

His mental qualifications, whatever called, are such as to enable him to perceive quickly and learn aptly. Hence he can be trained to perform incredible feats. The smuggler has taught him the art of carrying on his contraband traffic, both by land and water. The thief has taught him to purloin from a shop any parcel he had previously pointed out to the pupil; and the sheep-stealer has been successful in training him to find and bring to him from a large flock the very sheep he himself had selected in the dog's presence. So many extraordinary facts and curious anecdotes have been recorded as instances of the dog's mental ability, that they would fill volumes were they all put together. Doubtless some are too far fetched, and others are glossed over by a dilated imagination; still we do not withhold our credit from the truth of many that are most astonishing. Our space will only allow us to give the substance of a few examples, and we shall not go to the extremes to bring in the most startling illustrations either of instinct or of intelligence; we must prefer those every day things which are open to all eyes, and at all times. It has been too much the practice of writers on instinct, as well as that of the advocates of animal reasoning, to quote a few extraordinary and isolated facts, to comment on them merely, and to draw inferences from them only. And they have been content to build a theory upon exceptions simply, and have then been satisfied that they have established a principle. Are the exploits of one particular dog sufficient to give the rule of a thousand,

or it may be of ten thousand? The general rule must be the proper standard of judgment, and not the exception. We have just read an account of a Scottish girl of ten years of age being able to multiply mentally a prodigious, and, were it not well attested, an incredible numbers of figures; but no reasonable man will affirm that that feat ought to be taken as a fair specimen, or as an average of woman's mental powers. Yet the criteria by which many authors judge of the mental constitution of animals have not been much less extragavant.

We have said that we do not believe that animals are capable of working thought in an abstract manner; for, in order that mind may be in a capacity to perform functions of this nature, memory must be endowed with the ability to recollect. Now, as far as our observations have been extended, we have seen no animal operate by such method, otherwise than by instinct, as to give any satisfactory evidence of being gifted with that power. We hold that when an animal appears to recollect by an intelligent effort, and not by an instinctive impulse, it is by the aid of the power of association. It must either hear some sound, or come in contact with some substance or some scent, or see some figure, with any of which the matter in question stands associated in the mind of the animal, before it can recur to it. This, then, we consider a highly important principle, supposing, at least, that it can be properly substantiated. We shall not, however, attempt to sustain it in cases of unusual occurence; but we shall suspect all those facts which appear to refute it to be more the workings of a mysterious instinctive faculty than the legitimate operations of intelligence.

It will have been observed that we are inclined to exercise strong faith in the general principle, that in proportion to the physical matter of the brain, such is the degree of intelligence displayed by it. The dog genus affords us an exemplification. The greyhound and the bull-dog have the least development of brain; for though the head of the latter is large, the capacity of the cranium is small, while the forehead of the former is flattened, and accompanied with an elongated snout, which, as we have said, is the symbol of stupidity. The

intelligence of either is very limited, for neither is capable of profiting much either from experience or education. Yet, if some accounts that are given of coursing be true, the greyhound can derive benefit from experience; for it is said, that when an old and young dog are running together, the inexperienced hound instinctively follows the hare in every turn and winding, while the old courser sometimes takes the way the crow flies, anticipating the hare in her habit of doubling, and thus deprives puss of the advantage she otherwise would gain by making a sudden turn.

Some few old dogs may sometimes put this stratagem into execution, but we have never seen it, and are a little disposed to question the truth of its adoption as a general rule. It is just the sort of thing that, having once been put upon record, writers will copy from one book into another, without taking the trouble to make inquiry of a practical man. And even if the old dog were in the constant habit of doing this, and we will not affirm it is not the case with some, we should see less difficulty in ascribing it to an instinct than to any process of reasoning; for this animal does not reason evidently upon any other thing whatever.

But the powers of reason are flexible and accommodating, and admit of universal application. A judge upon the bench has an infinite variety of cases brought before him; but of all the diversities, not one comes upon which he cannot weigh and ponder the evidences. However wide the extremes in knowledge through which the cases may oscillate, none are ever found upon which his intelligence is not able to operate. However diverse the causes, he can draw inferences from the evidences of all with equal facility. He is not ready and sound upon one particular thing only, and strangely stupid upon all others. But this must be the case with the greyhound; that is, if we allow the animal to reason when coursing a hare, for most assuredly it is stupid enough under all other circumstances. If the hound is in possession of a reasoning faculty at all, why cannot that power perform its functions upon more things than one, and in more places than one? And because it cannot, we conclude that the dog's turning off to meet the game is not an

intelligent act purely, and that writers and advocates of animal intelligence have taken the fact for more than it is worth. In sentiment the greyhound is distinguishable from most other dogs in this, that he forms no particularly personal attachment; for though he is alive to caresses, and responds to all, it is to all friends nearly alike, and not to any one more particularly than another.

The bull-dog is remarkable for the fierceness of his attack, and the tenacity of his hold. Some barbarous and cruel experiments have been made upon this animal while in the act of seizing his antagonist, with the view of ascertaining if it were possible to make him desist; but all have been in vain. When once he has got his bite, nothing will oblige him to relinquish it, even though every foot he has be cut clean from his legs. And this manner of fighting is all this prodigy of brute ferocity ever does, or can be made to do. It is his only instinct, and a very remarkable and mysterious one it is.

The Newfoundland dog has a sagacity that is remarkably strong and humane in its character. This animal appears as if designed to be a companion to man, but more particularly when he is exposed to the perils of the water. With semi-webbed feet, which make him a good swimmer, and an inclination to enter the water, this element seems half natural to his nature. It is when persons are in the act of drowning that the sagacity of this dog displays itself most strongly, and innumerable lives has it saved from a watery grave.

One instance will serve our purpose as well as a hundred which might be enumerated. A singular case is given of a person who was travelling in Holland, and accompanied by a Newfoundland dog. Not taking proper heed to his steps in an evening walk along a high bank by the side of one of those deep canals common in the country, his foot slipped, letting him into the deep with a plunge, and being unable to swim, the fish's element soon deprived him of his senses. In the mean time the sagacious animal had no sooner discovered the danger to which his master was exposed, than he was in the water, and engaged in the struggle to rescue him from his peril. A party at a distance saw the faithful servant at one moment pushing, and at an-

other dragging the body towards a small creek, where at length he succeeded in landing his charge, and placing it as far from the water as possible. This being done, the dog first shook himself, and then licked the hands and face of his apparently dead lord. The body being conveyed to a neighbouring house, the efforts to restore the lost senses were successful.

From the marks of teeth on the body, it appeared that the dog had taken his first hold on the shoulder; but finding that this did not keep the head out of the water, the instinct or the intelligence, which? of the animal prompted him to change his grasp from the shoulder to the neck, by which he was enabled to raise the head above the strangling liquid for the distance of about a quarter of a mile.

That this brute creature should have followed his master with such promptness is remarkable enough; but that he should have taken the precaution to keep his head above water, as if he knew that if he did not he would perish, is truly marvellous. What was the motor power in this case? Was it an impulse of instinct, to which the dog rendered a blind obedience? Or was it an act purely of intelligence? Our opinion is that it was a mixed operation, and that both instinct and intelligence had a share in the business. That much of it was owing to instinct, we have the proof in the fact that the Newfoundland dog is not only always found ready to enter the water for such purposes, but even has a strong inclination for it, without either being commanded or directed, and without experience or a precedent. Perhaps the intelligence of this dog is more flexible and accommodating than that of any other species, but yet how infinitely short does it come of the universal? It has its limits, and if compared with the range man's reason takes, they will appear exceedingly narrow. We do not think, therefore, that the apparent sagacity in the feats of this fine animal is to be taken solely as the result of a purely reasoning faculty. The operations prove too much.

We find also that the notorious and surprising powers of the shepherd's dog are displayed in only one department of service; and that is among sheep. Here he

learns every lesson with astonishing aptness, and when once acquired, he performs his tasks with such a sagacious readiness, that it seems to come from the spur of the moment. He is faithful to a proverb, and is so eminently successful and useful in the pastures of plain and heath, and down, that no one can doubt for a moment that such is the service for which he was designed. Hence his most extraordinary fitness for it; not from any particularly reasoning powers we hold, for the very same reasons we have given with regard to the Newfoundland dog; but more from some peculiar intuitive and mysterious disposition or impulse in the animal itself. It is an endowment from nature. It is a principle that the Creator in his wisdom has implanted, and it works his sovereign will in a manner that is inexplicable to human reason.

Though we profess to refrain from introducing, as examples or criteria, any of those feats of animals which are too extraordinary and too exceptional to be often witnessed, we shall quote here an instance of a very surprising character, and which came under the observation of Mr. Hogg, the Ettrick shepherd, and which is told by himself.

Sirrah was the name of this famous dog, and Mr. Hogg was his owner. On one occasion 700 lambs broke up in an evening, and scampering off in three divisions, soon lost themselves among the neighbouring hills. Sirrah seemed to understand that this large flock of lambs ought not to be absent from their accustomed dwelling-place at night, and, without orders from his master, set off in search of them. The night was dark, and the shepherd and his companion spent the whole of its long hours in scouring the hills, but they could obtain no trace either of the seeking dog, or of the recreant flock. "On our way home, however," says Mr. Hogg, "we discovered a lot of lambs at the bottom of a deep ravine called the Flesh Cleuch, and the indefatigable Sirrah standing in front of them, looking round for some relief, but still true to his charge. The sun was then up, and when we first came in view, we concluded that it was one of the divisions which Sirrah had been unable to manage until he came to that commanding situation.

But what was our astonishment when we discovered that not one lamb of the whole flock was wanting! How he had got all the divisions collected in the dark is beyond my comprehension. The charge was left entirely to himself from midnight till the rising sun; and if all the shepherds in the forest had been there to have assisted him, they could not have effected it with greater propriety." We do not question the truth of this exploit; for although it was of most wonderful execution, it is so naturally characteristic of the shepherd's dog, that we give full belief to all its particulars.

The successor of Sirrah was Sirrah's son; and though not so famous a dog as was his father, he was yet a more interesting one. And Mr. Hogg relates an instance of Hector — for that was his name — manifesting a strong instinct, but a defective intelligence; indeed, this latter faculty always appeared more obtuse than that of his immediate and most notable predecessor. One evening, at dark, Hector and his master had safely enclosed a flock of lambs in a fold, and when the passage flake was shut, the dog must have been shut inside, and it was supposed that he did not discern that the lambs were made secure; for although his master called him away when he left, Hector did not obey the summons, and in the morning he was found standing inside the fold just at the middle of the fold door, with his eyes steadfastly fixed on the lambs, as if chained to the spot by some irresistible power. What was this but the instinctive impulse?

There had been a deluge of rain in the night, but Hector had never once been down, and in the fatiguing attitude of strict watchfulness did this patient and persevering representative of the shepherd spend the whole of that cold and dreary night. Hector's disposition to obey was strong, but the force of his peculiar instinct was yet stronger; for when called off, he yielded to his innate impulse, and refused to attend to the commands of his master, because his intelligence was at fault. The animal could not perceive that the lambs were already made safe enough in the fold, nor that his own watch was unnecessary.

Mr. Hogg tells a case of a young man having lost his life through the unconquerable force of his dog's in-

stinct. This young man had resolved to make an adventure in the crime of sheep-stealing; and having selected some sheep from the flock of a former master, he and his dog commenced driving them away; but before he had got them off the farm, he, whether from the voice of conscience, or from the terror of possible consequences, countermanded the execution of the project, and let the sheep go back again. He called his dog away, and mounting his pony, rode off at a gallop. But halting at the distance of three miles, and turning round, he there saw the stolen sheep at his heels, with his dog in their rear, driving them after him at a furious rate. The young man was in trouble, and after punishing the thief for his disobedience, rode off a second time. The dog, however, was quite incorrigible, gave his master the slip, and again fetched up the poor animals, already panting and smoking from the effects of the rate of their recent travel. This time the day was beginning to dawn, and the young man began to feel that it was impossible for him to make a defence against such overpowering evidence, and, seeing he could not wash his hands clean of the stolen property, disposed of the sheep, and the transaction cost him his life.

For the last four or five miles the dog had to scent his master's track, as well as to drive the flock before him. It is very plain that this animal was under the influence of his proper instinct, which was so strong that no other power was competent to resist its impulse. His intelligence should have made him obedient to his master's commands; but his instinct led the other way, and the business of his instinct he would do. And this fact confirms us in the opinion we have before broached, that when animals exhibit some apparently clear evidences of strong sagacity in one particular service only, it may be concluded that the motor power is more of an instinctive than of an intellectual faculty.

The blood-hound is a most extraordinary animal, and possesses some marvellous features in his instinct. According to Mr. Bell, a Mr. Boyle, "to make trial whether a young hound was well instructed, desired one of his servants to walk to a town four miles off, and then to a market town three miles from thence. The dog,

without seeing the man he was to pursue, followed h by the scent to the above-mentioned places, notwi standing the multitude of market people that went alo the same road, and of travellers that had occasi to come; and when the blood-hound came to the cr market town, he passed through the streets, with taking notice of any of the people there, and ceased r till he had gone to the house where the man he soug rested himself, and where he found him in an up room, to the wonder of those who had accompanied h in this pursuit."

The English blood-hound has a wide forehead, w an obtuse nose, and expansive nostrils. His tongue awfully deep and highly sonorous, while a degree serene ferocity is spread over his countenance; a though his character is supposed to be full of decid enmity to man, it is yet considered doubtful whetl this dog, whose

> "Nostrils oft, if ancient fame sings true,
> Trace the sly felon through the tainted dew,"

would, in a tame state at least, devour him, were he r trained to it, as has been done in the West Indies, feeding him upon blood, and setting him to chase figure representing a negro, and containing blood a the entrails of beasts. He is distinguished by that markable property which will never change from t particular scent upon which he is first laid, whether be by the foot or by the shed-blood of an animal; a it is said that nothing will destroy the scent from l power to detect it, except blood spilt upon the track.

Almost every reader of natural history is famil with the capture in Cuba of some Spanish sailors, wl when passing the island, ran the ship ashore, and af murdering the English officers, carried away all t available plunder to the wild and unfrequented retre among the mountains, where they believed all purs would be vain. A body of twelve chasseurs with th dogs was obtained from Havanna, and these infallil pursuers being put upon the scent, were very quicl upon the heels of the fugitive murderers, who were imn diately captured without being hurt by the dogs, a

a few days sufficed to bring every man of them to judgment, which was speedily followed by the execution of the whole gang.

About the beginning of the present century there was, it appears, at Thrapstow, an association formed for the prosecution of felons, and a blood-hound was kept and trained for the detection of sheep-stealers.

"To demonstrate the unerring infallibility of this animal, a day was appointed for public trial; the person he was intended to hunt started in the presence of a great concourse of people, about ten o'clock in the forenoon, and at eleven the hound was laid on. After a chase of an hour and a half, nothwithstanding a very indifferent scent, the hound ran up to the tree in which he was secreted at the distance of fifteen miles from the place of starting, to the admiration and perfect satisfaction of the very great number assembled upon the occasion."

It has been observed that when the object of the blood-hound's pursuit crosses a river, and the scent not readily found on the other side, the dog will make a considerable circuit in order to intersect the track that must have been taken. That this animal should be able to trace with unerring certainty any person through numerous streets and busy thoroughfares, where the track has been crossed and recrossed by hundreds of individuals of a kindred scent, is a feat that strikes every contemplative mind with astonishment. What mind of man can comprehend the refined sensibility of his olfactory nerve? It is so sensitive that the least atom of scent will affect it; for neither the principle of gaseous diffusion, however constant and insidious, nor the agitation of the aerial elements by the winds, however violent, is able to remove from the track all the taint the man or animal to be hunted leaves upon it; for it seems that even after these two potent forces, and others as well as these, have done their utmost, this determined dog will yet find sufficient left to discover the path of the fugitive. We may and ought to admire it, but we cannot understand it.

We observe here that the intelligence of the blood-hound is confined within very narrow limits, for he can be

instructed only in the business of his very mysterious instinct. What strength of power could teach, or what force of habit could make this hound perform, the part of a shepherd's dog among sheep? His nature would be an insurmountable obstacle in the way of accomplishing such a task. Which, then, is the ruling or the preponderating power, instinct or intelligence?

There is another dog that presents to all observers of nature's operations some truly wonderful phenomena, which greatly and equally excite the curiosity of the intelligent and the admiration of the devout; for this creature, which is the pointer, unites to the quality of a good nose, the singular and remarkable habit of coming in a very curious manner to a dead stand upon the scent, and is satisfied with merely indicating the position of the sportsman's game. The sense of the pointer's smell is not so acute and extraordinary as that of the blood-hound; but his power of scent, which is nevertheless very strong, and accompanied and blended with the habit of pointing out the presence of game before it can be seen, makes him, perhaps, a more wonderful and interesting subject of study. His mode of pointing is alike striking and characteristic. The moment he falls upon the scent, he not only makes a sudden halt, but assumes at once an attitude of very great peculiarity, and such as must be seen before it can be fully appreciated or understood. In an instant he may be seen standing upon three legs, one of the fore feet being raised; and, what is unexampled, his face, his back, and his tail, are all in a line. This is his invariable position when the scent is taken naturally; but when it is interfered with, such as running with the wind, or barred by an impenetrable fence or any other circumstance, and the dog tumbles in consequence suddenly upon the game, he then pulls himself up so instantaneously, that not one of his limbs is suffered to move after the instant the scent is discovered; and however great the singularity in the conformation of his body at that moment, or however painful to him, that attitude, which is sometimes most peculiar, and sometimes quite grotesque in appearance, he will maintain with remarkable steadiness, until the sportsman arrives to put an end to his marvellous suspense. In such cases the

dog appears as if conscious of having got too close upon the birds, and as if he recognised the danger of disturbing them before any shot could be given. Sometimes it has happened that when the pointer has been in the act of springing over a strong fence, such as a stone wall, he has hit upon the scent of birds lying close to it on the other side, and he has then been seen to halt suddenly upon the top of it, with his four feet all collected together, and his body almost doubled up, thus fixing himself like a statue. An old experienced and feeble dog, however, will sometimes have recourse to the expediency of sitting down upon his haunches while pointing, with his face directed towards the game, yet ever and anon turning his head to see whether his master is giving him attention, and wistfully wishing the approach of the gun.

Mrs. Lee records the following instance of the force of the pointer's instinct: — "Mr. Gilpin speaks of a brace of pointers, who stood an hour and a quarter, without moving. This, however, was exceeded by Clio, a dog belonging to my father, who stood with her hind legs upon a gate for more than two hours, with a nest of partridges close to her nose. She must have seen them as she jumped over the gate, and had she moved an inch, they would have been frightened away. My father went on, and having other dogs, did not miss Clio for a long time; at length he perceived she was not with the rest, and neither came to his call nor his whistle; he went back to seek her, and there she stood just as she had got over the gate. His coming up disturbed the birds, and he shot some of them; but Clio, when thus relieved, was so stiff that she could not move, and her master sat down on the grass and rubbed her legs till she could bend them again."

It is said that the natural habit of the pointer is to steal cautiously up to his prey, in order to capture it with a sudden spring, and that his stand in pointing is an educated modification of this instinct. If so, why then does not a young pointer follow the original habit? This he never does, but points after the manner of the old ones, before he has had any training or experience. It is, moreover, a habit that is unnatural to any of the

tribe. Stealth is a strong characteristic of the feline race, but it is remote from the nature of the canine.

"The instinct of pointing," says the author of the article "Shooting," in that great work, the Encyclopædia Britannica, "we apprehend, is an inextinguishable and indestructible principle in the blood of the pointer, which, however it may be mingled with inferior blood, will always, in some degree, manifest itself; and on this ground we build our theory that the further any dog is removed from the original Spanish pointer the worse the dog is." Education may bring this dog under command while following the course of his instinct, but it can neither alter that faculty, nor change its direction.

The following is taken from the same book just mentioned: — "If dogs were unknown in Europe, and some traveller from a distant part of the southern hemisphere were to relate that he had seen a new species of quadruped with wonderfully fine olfactory nerves, by the aid of which it was enabled to hunt to death the hare, stag, fox, or jackal, the tale would readily be credited; for the instinct of the hound, as compared with that of other animals, is not such as to excite surprise. But were the traveller to relate that he had seen a quadruped which, untaught, would stand motionless, as if converted into a statue, on coming in contact with the slightest scent of game, he would not be believed; it would appear incredible, such is the extraordinary instinct of the pointer and setter. We use the term *extraordinary* advisedly. There are other animals, and indeed other dogs, which possess a degree of instinct more nearly approaching to reason, but none possessing so extraordinary an instinct, not analogous to that of any other living creature that we are aware of. The pointer seems to be endued with it for the exclusive service of man; whereas the instincts of all other animals are conducive to the supply of their individual wants, and their usefulness to man is secondary thereto. It would be difficult to controvert the argument that this instinct was given to the pointer for the purpose of aiding men to capture or kill game, by means of engines as nets or guns. This, we are aware, may be a doubtful position to maintain;

but who can say for what other apparent purpose this peculiar faculty was given? It may, indeed, be urged that the propensity to point in the pointer is a means ordained by providence for his subsistence in a wild state, by enabling him to approach within the reach of his prey, and thus to accomplish, by another species of stealth, what the tiger and other animals of the cat tribe effect by ambuscade. Such an argument, however, is presumptuously rebutted by the fact that all existing races of wild dogs are gregarious, and resort to the chase for food; nor is there any record of the existence of dogs in a state of nature, except those calculated for the chase."

The pointer possesses a considerable share of intelligence, since he can be trained to obedience: but he again cannot be taught to perform any task that does not come within the province of his proper instinct; for instance, this dog, unlike the Newfoundland, will not fetch or carry any object in his mouth, not even the game he has pointed. The difficulty of modifying his aversion to water, briars, and gorse bushes, cannot be surmounted, and for this kind of practice the setter is brought in as a substitute. The apt faculty, then, in the pointer to indicate the presence of game, is an instinct, and not intelligence, which would be more flexible and accommodating in its application. We take, therefore, the facts as confirmatory of our general principle, that when an animal has the ability to act on one stage only, it operates under the influence of an instinctive faculty, and not under that of an intellectual one.

There is a feature in the character of the hound which deserves some notice, and that is, his indomitable perseverance. The most remarkable illustration of this determined impulse is to be found in the account of a stag-hunt which took place many years ago in Scotland. The stag was turned out of Whinfield Park, Westmoreland, the hounds followed, and were seen giving chase to him near Annan, in Scotland, which was a distance of not less than forty-six miles from the place of starting in the north of England. The stag having turned round, made for home again, keeping ahead of the dogs all the run; but he had exhausted all his power to move, and

with it the very life of his body, for he had no sooner taken his last leap over the park wall than he fell and instantly expired. Only two dogs came up, all the pack except these had been thrown out by fatigue or accident, and even these could not reach the object of their pursuit, for their power to run further was gone also, and their life departed likewise. They had nearly made the wall; but being totally unable to take this last leap, they fell dead on the outer side of it, and there, within a few yards of each other, lay the three lifeless animals, the stag on the one side of the wall, and the dogs on the other, the one the victims of an indefatigable instinct, the other the victim of the chase. The distance run was supposed to be not less than 120 miles. How nearly balanced were the powers of foot in the dogs and the stag. Why such a relation? How came it?

Some methods of giving chase among dogs are of no mere ordinary interest to the naturalist. The hound announces his discovery of the scent by a strong cry, or by giving tongue as long as he keeps it, more or less loud and quick, as he is more or less near to the object of pursuit. In the case of a find of a fox, one dog begins to open his mouth, sometimes at first it is at intervals, as if in doubt, but soon a second, and a third cry is heard; and quickly the whole pack, though scattered all over a cover, will converge to the point of attraction, and all getting assembled on the tract, they pour out a united cry in pursuit that is not altogether devoid of melody. We may discover the use of their tongue in the fact of its enabling them to unite all their forces, by its giving notice to the distant and straggling hounds, for it is necessary to spread them out, in order to draw a cover perfectly. Did the few finding dogs, like the greyhound, give chase in silence, the rest of the pack would never come up at all. Yet we must suppose that the dogs do not know the purposes their cry answers. They do it merely because they cannot help it. The impulsive power is within them, and their cry is involuntary and irrepressible. It is not wanted in the greyhound, for his game is chased by sight, and the instinct to give tongue is altogether absent.

We have often seen a pack of fox-hounds, as well as of

stag-hounds, in full cry, and we have always been struck with the plodding and apparently hasteless character of their progress. Most other dogs are greatly excited while on the track of game, and make great manifestation of it; but the fox-hound and the stag-hound in particular seem so calm, and take it as such a matter of course, that they appear to resemble an imperturbable man, who, though overtaken with a disaster sufficient to put most men out of their senses, can yet remain unmoved. This quality in these hounds has never failed to strike us, nor have we ever ceased to admire it.

Lest from our manner of writing on this subject we should be thought to give encouragement to hunting and the sports of the field, it will not be improper just to disabuse our readers of that notion, should any have received it. We believe it is high time that the pastime of hunting in England was at an end. We object to it on many grounds. It is a national as well as a moral evil. England is becoming crowded with people, and it is not only necessary to provide for their bare subsistence, but it is incumbent upon the wealthy classes to see that they do not impede the cultivation of the ground, nor destroy the fruits of the husbandman's industry when he has spent his labour to bring them forth. While there are so many thousands of famishing families as are to be found in this country, we hold that it is not morally right that large portions of land should be suffered to lie waste for the sake of giving a few sportsmen an occasional opportunity of indulging their passions for the field.

Morally, too, it dissipates man's mind, but we will say no more than to ask every sportsman to remember, that while he is gratifying himself in a superfluous luxury, obstructing the culture of productive soil, and damaging the prospects of the agriculturists, there are hundreds upon hundreds of little children who know not what it is to have a sufficiency of bread to eat.

The habits of the dog in his wild or savage state must just be mentioned. And it is well known that if they no not live in troops, they associate together for the purpose of securing their prey, and hunt it in packs; so that when they do not find amongst them that being

whose society they prefer to that of their own species, they become sociable with one another. It may be remarked that the wild dog hunts only to supply his necessities, without appearing to take any further pleasure in it, while in a tame state he is always delighted with it, and in being accompanied and conducted to the chase by man, whose superior guidance and understanding the animal seems to appreciate. The wild dogs in the north of Canada and India will hunt and attack the most formidable of animals. Wild boars, bisons, tigers, and even lions, will be selected as objects of chase; and when such is the case, these otherwise triumphant beasts must be content to come off second best, even if they do not fall the victims of the dogs' relentless worry. In this untamed state, the bark of the domesticated dog is unheard, but they have the instinct to give cry, and they make a wolfish howl, instead of the more musical tongue given by the fox and stag hounds.

Is it, then, instinct or sagacity which assembles these wild dogs together for the purpose of hunting their prey? How should they know that a union of their forces is necessary to bring down and conquer the object of their chase? If by knowledge, is that knowledge obtained by experience or instruction, or by both in part? We believe it is done independent of experience, and that their intelligence is insufficient to account for it. The balance of evidence points us to instinct, as being the captain of these chasing companies.

We shall dismiss the dog tribe with just a reference to their mode of attack, which they adopt in order to make it as effective as possible. All animals which are furnished with weapons of attack or defence, always use them as if they understood the most effectual way of of doing it. The dog has no sooner seized hold of his foe than he begins to shake him with might and main. The object of this is, whether the dog knows it or not, to take all the advantage of his bite, to tear the flesh as much as possible, and by these means to worry his antagonist to the utmost. This remorseless manner of carrying on the conflict is peculiar to the dog, and all the different species do it in the same way, only some more or less fiercely than others. The fact that the

young of all animals apply their weapons in the right and best mode is a very decided proof of its being the result of a pure instinct, and not of intelligence.

The Fox.—The fox is an animal of the most marked notoriety. He is a wary and skilful depredator; and though, for his size, a great glutton, his rapacity is more than equal to his voracity; for he puts to death all that fall victims to his power, irrespective of the quantity sufficient to supply his pending wants. Reynard, however, is provident withal, since he carries off the spoil to some distant and convenient spot, where he hides it in different places; and thus, by repeated journeys, he transports and stores away all his booty before he makes his own retreat from the scene of his violence. He is solitary, and seems to live a life of unexampled suspicion. When taking a predatory excursion on his own account, he proceeds with the utmost caution, suspecting not only every body, but everything that is to be heard or seen. Hence how natural that such an animal should conceal himself during the day, and roam at night in search of his prey, for his deeds will not endure the light. His cat-like eyes are evidently designed for nocturnal prowling. The pupil of his eye is not round, but linear and vertical, and gleams with such brilliant light that it is sufficient to fascinate the hen from her roost, or to strike her with some other inexplicable power. The fox is too coy to be often entrapped, and much too sulky to be tamed when caught. When hard run, he has been known to have recourse to surprising stratagems, and the feats of Reynard upon record are so numerous that they have established for him a world-wide fame. We will make a selection of some few from those which we consider the best authenticated, and coincide most with the natural character of this famous animal.

The following sort of dramatic performance was acted by Reynard in the presence of Mr. St. John, who brought it to a rather tragical close, and who is the narrator of it:—"Just after it was day-light, I saw a large fox come very quietly along the edge of the plantation; he looked with great care over the turf wall into the field, and seemed to long very much to get hold of some of the hares that were feeding in it, but

apparently knew that he had no chance of catching one by dint of running. After considering a short time, he seemed to have formed his plans, examined the different gaps in the wall, fixed upon that which appeared to be most frequented, and laid himself down close to it, in an attitude like that of a cat at a mouse hole.

"In the meantime I watched all his plans; he then with great care and silence scraped a small hollow in the ground, throwing up the sand as a kind of screen; every now and then, however, he stopped to listen, and sometimes to take a most cautious peep into the field. When he had done this he laid himself down in a convenient posture for springing on his prey, and remained perfectly motionless, with the exception of an occasional reconnoitre of the feeding hares. When the sun began to rise, they came, one by one, from the field to the plantation; three had already come without passing by his ambush, one within twenty yards of him, but he made no movement beyond couching still more flatly to the ground. Presently two came directly towards him, and though he did not venture to look up, I saw, by an involuntary motion of his ears, that those quick organs had already warned him of their approach. The two hares came through the gap together, and the fox, springing with the quickness of lightning, caught one and killed her immediately; he then lifted up his booty, and was carrying it off, when my rifle-ball stopped his course."

In Brown's anecdotes there is a case given of a fox-hunt that took place in Galloway in 1819, in which Reynard saved himself by the following stratagem: — The fox, being hard run, took a leap over a high wall, and then crept along close under the other side; but as soon as the hound had cleared the wall, the sly animal sprang back again, and this device proved completely successful, for the impenetrable fence broke off the scent from the dogs, and the fox had time to effect his escape.

"While an old man was wandering by the side of one of the largest tributaries of the Almand, he observed a badger moving leisurely along the ledge of a rock on the opposite bank. In a little time a fox came up, and

after walking for some distance close in the rear of the poor badger, he leaped into the water. Immediately afterwards came a pack of hounds, at full speed, in pursuit of the fox, who by this time was far enough off, floating down the stream; but the luckless badger was instantly torn to pieces by the dogs.

"An instance of still greater sagacity in the fox occurred a few years ago, also in this neighbourhood. As a farm servant was preparing a small piece of land for the reception of wheat, near to Pumpherston Mains, he was not a little surprised on seeing a fox slowly running in the furrow immediately before the plough. While wondering how it was that the sly creature was so confident, he heard behind him the cry of the dogs; and turning round, he saw the whole pack at a dead stand near the other end of the field, at the very spot where Reynard had entered the newly enclosed trench. The idea struck him that the fox had taken this ingenious way of eluding pursuit; and through deference to the sagacity of the animal, he allowed it to escape.

"Whenever a cat is tempted by the bait, and caught in a fox-trap, Reynard is at hand to devour the bait and the cat too, and fearlessly approaches an instrument which the fox must know cannot then do him any harm. Let us compare with this boldness the incredible caution with which the animal proceeds when tempted by the bait in a set-trap. Dietrich aus dem Winkell had once the good fortune of observing, on a winter evening, a fox, which for many preceding days had been allured with loose baits; and, as often as it ate one, it sat comfortably down, wagging its brush. The nearer it approached the trap, the longer did it hesitate to take the baits, the oftener did it make the tour round the catching place. When arrived near the trap, it squatted down, and eyed the bait for ten minutes at least; whereupon it ran three or four times round the trap; then it stretched out one of its fore paws after the bait, but did not touch it: again a pause, during which the fox stared immovably at the bait. At last, as if in despair, the animal made a rush, and was caught by the neck."

Not a subject of small interest is the great concern which the female fox manifests for the welfare of her

young, and Goldsmith records the following illustra
" A remarkable instance of this animal's parental t
tion happened while I was writing this history, in
county of Essex. A she-fox that had, as it should s
but one cub, was unkennelled by a gentleman's hou
near Chelmsford, and hotly pursued. In such ca
when her own life was in imminent peril, one wo
think it was not a time to consult the safety of i
young; however, the poor animal, braving every dang
rather than leave her cub behind to be worried
the dogs, took it up in her mouth, and ran with it in th
manner for some miles. At last, taking her way throug
a farmer's yard, she was assaulted by a mastiff, and a
last obliged to drop her cub, which was taken up by
the farmer. I was not displeased to hear that this
faithful creature escaped the pursuit, and at last got off
in safety."

There is a very curious circumstance connected with the removal of the young of the fox, of the cat, and of the dog, by their old ones, from one place of danger to another of greater security. All are, more or less, in the habit of doing it; but the cat more so, perhaps, than the others. Should any person take up some kittens, puppies or cubs, and displace them, the little things will whine so piteously as to excite to the utmost the compassion of maternal affection; nor, do what you will, is it possible to pacify them. It matters little how carefully and gently they are handled, nothing will prevent their giving utterance to their trouble. Though touched by the human hand, and this would seem an instrument much more soft and fitted for such a purpose than the mouths and teeth of their mothers, the little animals appear to be fully conscious that they are being meddled with by a stranger. But let the fox carry off her cubs for miles in her mouth, or the cat her kittens, and the young creatures make no disturbance at all, either in the act of removal, or when deposited in a strange place of abode. They then whine not, neither do they writhe; but suffer themselves to be carried away in the apparently roughest manner, and that to any extent, and all the time as quiet as a lamb in contentment, as if they really understood that it was necessary

for their safety to be still, and as if the old mothers had communicated to them a sense of their peril. This is a most inexplicable and mysterious phenomenon.

The human intellect has no means of penetrating the mystery; yet it is a very common fact. However much of understanding may be allowed to the dog, the fox, and the cat, as a guide to themselves in this matter, none can be granted to the puppy, the cub, and the kitten, that have scarcely seen the light. In these young ones, therefore, it must be the result of a pure instinct; while the part acted also by the old ones in taking their offspring from one place to another is probably prompted more by the same faculty than by their own sagacity. Now the human infant, before the dawn of its reason at least, cannot be so hushed into silence; nor can any apprehension of danger be imparted to it. Instinct not only begins to operate at birth, but it then does its business with as much perfection as ever it does; while reason not only does not begin with life, but only opens gradually and slowly when it does begin.

"The cunning of foxes," says Lord Brougham, "is proverbial; but I know not if it was ever more remarkably displayed than in the Duke of Beaufort's country; where Reynard, being hard pressed, disappeared suddenly, and was, after strict search, found immersed in a water-pool up to the very snout, by which he held a willow bough hanging over the pond." And we ourselves have known cases in which, when hotly pursued, Reynard has taken to a newly-made hedge, and run along the top of it for a considerable distance. In all these cases the object is to destroy the scent as much as possible, and it is true that the animal takes the best of the means that are at hand of doing it. How far the fox in such instances recognises the means to the end by any intellectual faculty is another question, and involves a point of no small doubt.

It has been known, on more than one occasion, that the fox, when taken by surprise, has feigned death very readily, and accordingly has stretched himself out on the ground like a corpse. The following remarkable instance, contributed by Mr. Mudie, is given in Partington's Cyclopædia: — "One morning early a man in the North

was going to his work through furze-bushes on a common, and came upon a fox stretched out at length under the side of one of the bushes. The fox was drawn out by the tail, and swung right and left, and then laid on the ground; but not a symptom of motion or life did he show. The man, never doubting that Reynard had gone the way of all foxes, and nothing loth to add a fox-skin cap to the list of his personal garniture, and the brush to the tail of peacock's feathers and other ornamental trophies over the little looking-glass that stood inclined from the wall of his cottage, took the animal by the tail, and swung it over the one shoulder, at the same time placing his mattock on the other, to keep up the balance; and having done so, onward he trudged to mend the high road. The animal had counterfeited death to admiration, and he did not mind being carried in the manner of a dead fox; but he had no inclination to undergo that species of dissection which the point of the mattock was ever and anon giving his ribs; so, at last, he gave that decisive snap which is the characteristic bite of foxes, on that portion of the labourer's rear which is supposed to be more sensitive to all manner of inflictions than any other region of the human body. The man felt that something was the matter, but knew not very well what; so throwing the fox and the mattock from him, he turned round to face the foe, whoever he might be, and in turning he espied his dead fox at the distance of full fifty yards, making for the brake with all imaginable speed.

"We shall mention one other anecdote, which came within the personal knowledge of the writer of this article, because it throws some light on the mode of action of the fox, as well as confirms the truth of his counterfeiting death, in all cases where there is a likelihood that it may ensue. The parsonage of Kilmorac, in Inverness-shire, is situated in a highly romantic spot, and the clergyman of Kilmorac was a man of great taste, and very hospitable; and he accordingly endeavoured to provide for his guests all the good things which his glebe land would afford. A well-stocked poultry yard is an essential requisite in such cases; but here foxes were so numerous, and their covers so near, that a poultry yard *was out of the* question. A poultry house was thus re-

quisite, and the reverend doctor prided himself not a little in having constructed one which was completely fox proof; and for a good many years it had been impregnable. A friend of ours had spent a night in this romantic and hospitable abode; and while fresh salmon from the Beauly formed one article for the breakfast table, new-laid eggs from the stronghold of the hens were, of course, to form another. The purveyor in these cases took the key and marched off, basket in hand, to bring the supply; but when she opened the door, a scene of the most direful havoc presented itself; every perch and nest-hole was bedabbled with blood; dead hens lay in dozens on the floor, and in the middle was a full-sized fox, stretched out at full length, and, apparently, a sharer of the common mortality. The maid never doubted the death of the fox, but attributed it to a different cause, namely, that he had so gorged himself on the poultry, that he had burst. Here were three causes to rouse the mingled wrath and contempt of the servant; and after some exclamations she took him up by the tail, and swung him with all her might into the receptacle in which were accumulated the requisites for garden compost. The fox fell safely, and rose again speedily, and scoured along until he gained the cover of the woods, leaving the servant in utter consternation."

It is related of an American sportsman of Pittsfield, that after having pursued a fox with two blood-hounds for nearly two hours, the dogs came suddenly to a halt and appeared at fault. But they still yelped about, and tracing the circumference of a circle only a few roods in diameter, they intimated that the scent was not lost, and that it did not extend beyond the limits of the circuit they formed. Presently the huntsman came up, and in looking about him was surprised at the dog's motions, but at length was more surprised still when he discovered Reynard lying at full length, as if lifeless, upon a large log of wood that was somewhere near the centre of the circle. He approached, and saw the fox breathe, but could not direct the attention of his hounds to the spot. The counterfeiting animal manifested no signs of alarm at his presence, nor did he move until he was struck at by the sportsman with the branch of a tree, which obliged

him to leap from his lurking-place, and the dogs immediately pounced upon him.

When being chased, too, Reynard always appears to act as if constantly yielding obedience to the dictates of reason. If, for instance, there is a breeze, he will run with the wind, if possible; or, if that be not practicable, he goes diagonally to it. He shapes his course for the most woody country, and selects for his immediate run the path that is most embarrassing to his pursuers, which is the one that is most thickly set with thorns and briars. As often as possible he makes his way through low and watery ground, where his scent is soonest destroyed. He goes forward in a direct line before the hounds, but at no greater speed than necessary, as if his intention was to husband his strength to the utmost; and when overtaken, he defends himself with the greatest desperation, and sells his life most dearly at last.

What, then, is the nature of the fox? Must it be classed with mental powers, or with instinctive faculties? Among which of these is the seat of that authority, which directs so skilfully all his actions? How does he come in possession of so much skill? Is it an endowment, or an acquirement?

"The fox," says a late writer, "goes warily to work; and having discovered from *experience* that he is in danger of a foe or a snare at every turn, he has recourse to that subtilty which a combination of fear, caution, and appetite, influencing a shrewd disposition, can bestow, and which have won for him a wide-spread renown."

These remarks appear to us to embody no philosophy at all; they are quite wide of they mark. They are mere statements, resting upon no supports. The premises are put down in an advanced position. The argument is founded on error, and the reasoning brings forth accordingly erroneous conclusions. The explanation is totally insufficient to throw any light upon the dark point that is the hidden source of the operations; for, in the first place, before a fox can be said to have obtained experience of a snare, he must have been caught, and if once entrapped, the probability is that he would have been killed, or at least disabled. Now a lame fox

is rarely ever found. Besides, it cannot be supposed that every fox has, some time or other, been caught in a trap, yet all foxes are equally wary and cunning; and if they have not been ensnared in this way, how then can they have derived experience from such means? The cunning of the fox, therefore, is not the result of experience, for there has been nothing adequate to produce it.

It is true that Reynard's devices are very much like the contrivances of human reason; too much so, we think, for the argument of those who ascribe the animal's skill to an intelligent principle, for the facts prove too much. If they are the work of his intellectual powers, then the fox must be considered a very profound reasoner in his way. But this hypothesis derives no support from the physical structure of the animal. His brain is too small, and his muzzle too pointed. The former is only $\frac{1}{205}$th of the bulk of his body, and the formation of the latter is indicative of stupidity. We conclude, then, that the marvellous quality is innate. The power that influences this so called cunning animal is, therefore, a mysterious Instinct. It is an endowment from Nature, and no attainment.

Some very curious questions may be started with respect to the habits of Reynard. How does he know, or how does he become conscious, that he has a scent at all? Why should he understand, or seem to understand, or act as if he really did understand, that it was by means of the scent he left behind him that he was pursued? And, what is still more marvellous, how should he know the way to destroy it? As, for instance, that of directing his course over the lowest and most splashy grounds; that of plunging himself into the water; that of running along the furrow immediately before the team that his odour might be ploughed in; that of running along the top of a hedge that the taint might be raised above the dogs' noses; and, lastly that most consummate trick played upon the less wary badger.

To have devised some of these plans would have required what, in common language, is called a sharp fellow. What man, for instance, although of no mean

ability, would, on the moment, have suggested to the fox the expediency of having recourse to the furrow, as the safest means of covering his scent from the almost infallible noses of his indefatigable pursuers? Nor less wonderful is the dodge Reynard made with the badger. Both these facts involve an amount of knowledge somewhere which is greater than that possessed by men of average information; while they involve also some reasoning faculty, or something equivalent to it, that is stronger and more acute than that which belongs to men in general. Such an amount of knowledge, and such force of reasoning, we cannot concede to an animal; we attribute, therefore, the actions and the famous artifices of the fox to some power different from that of intelligence, inasmuch as many of his operations cannot be explained by the latter principle.

The fox displays most skill, perhaps, in the act of self-preservation, and more especially in a crisis of imminent danger. He accommodates his artifices to the circumtances and situations of the moment. This fact, it may be said, is a strong proof of an intellectual power. But has instinct no accommodating quality? Why should it not? Admit this, and much of the difficulty in regard to animal intelligence vanishes. Some cases there are in which it is most difficult not to allow it. And the most remarkable is that of a bee, repairing its broken comb. Here we cannot see how it can be refused, unless this insect be considered a reasoning creature, and some authors seem to have written with the view of making the supposition good. It appears to us so absurd that we do not entertain it for a moment, and the habits of the bee entirely refute the notion; but this matter will be fully explained in its proper place.

"Taking instinct, therefore," says Dr. Hancock, "to be a principle in the constitution of animals, given them by their Maker for the purpose of preserving the individuals and continuing the kind, its accommodating itself to circumstances and situations is no argument against its existence, nor a good proof that it is always the result of reasoning; because he who made it a part of the constitution of his creatures, knows that the same ends must be often sought by different means, especially

when times, places, and circumstances are altered. For if this accommodating property were not imparted to instinct, it would not produce the effects for which it seems intended, as we know that it is impossible that similar means should produce similar effects, when circumstances, climates, and situations are different. The accommodating variations only occur where the disadvantages exist, against which the instinct is intended to provide."

The structure of the fox combines elegance with an adaptation of parts to the predatory and solitary life he is destined to live; and, in like manner, his instinctive faculties are such as to put him on his guard against falling an easy victim to the perils to which his natural habits expose him.

CHAP. X.

The Beaver. — Unlike Man who studies. — Its Instinct very striking. — As if acquainted with Laws of Gravity. — Its Brain. — Animal Intelligence.

Lord Brougham says that the beaver "may be called, in respect of its works, the bee of quadrupeds, or if you will, of intelligent animals, holding among them as high a place as does the bee among instinctive creatures."

The resemblance is in the civil polity and social habits which pre-eminently characterise both. The beavers work in concert, and in addition to their private dwellings, rear in common a public work that is useful to all the families which form a settlement. This is economy of labour; what, then, is their guide in this matter, for we apprehend that these animals act blindly as regards the ends, and are totally incapable of understanding it? The curious motor power lies deeply hidden in darkest mystery, and this it is which makes the habits of this peaceful, industrious, and harmless creature of peculiar interest to every reflecting mind. Its operative faculty is, as will be seen, more decidedly and purely instinctive than that possessed by any other mammal. It is our business, then, just to examine the character of the ani-

mal's architecture in connection with the purposes it has to serve, and to notice its mode of collecting and preparing the materials that are necessary for the building, for herefrom comes the manifestation of that power which is the subject of our inquiry, and in it are to be discovered as many objects of admiration as of wonder, and such, we believe, that no intelligent human being can contemplate without being the subject of both.

The communities of beavers in North America do not always build their houses without some variety in the situations; but they are constructed either upon lakes or ponds, or upon those narrow creeks which connect the lakes together. Running water, however, is preferred, on account of the use that can be made of the current. If the water of the river or creek is liable to be drained off by its sources being frozen, so as to become below a convenient point, the apparent wisdom of these animals teaches them to provide against that evil by constructing a dam or dyke across the stream, below the spot in the bank they select as the place of their private dwellings. Now this dam, moreover, is not uniform in shape, but varies, according to the circumstances of the place, with remarkable precision and fitness. If the current of water is slow, and has but little force in its motion, the dyke is run across nearly in a straight line; but if the stream is rapid and of great strength of motion, the dam is formed into a considerable curve, with its convex side towards the current, that is, on that side which is next their habitations. The design of the dam is to retain a sufficient depth of water in the river opposite the bank in which the beavers construct their places of abode.

What, therefore, is the object of this breakwater simply, and what the object of the curve in particular? It is plain in both cases; that is, plain to men now that they have discovered the laws of mechanical force, but not before; for we question whether any man who did not understand them, and who was without any experience of the art, would do as the beaver does, were he required to set about the means to answer the same purpose. The probability is, that he would rear a dam across the river under any circumstances, and that in a

line as straight as could be, thinking it would be the least labour to go the way the crow flies. The use of the curve in the direction, and of the slope in the bank, it may be safely affirmed, would never occur to him.

Everybody now knows the leading principle of an arched bridge; that it is to give strength to the structure, and that the arch is the form which secures more strength, with the same amount and quality of materials, than that of any other. But how does the beaver get hold of this? Without doubt the object is the same, for the animal forms the curve only when it will be required, or when there will be a strong force to resist. Man has discovered the principle by bringing experience to the aid of his reason; but the beaver goes direct to work without experience, and, moreover, without hesitation, not in the least perplexed with a doubt about the possibility of being wrong. Its guide is infallible, and this is something superior to human reason.

There is, too, another feature about the construction of the dam that is not less striking, and displays not less beautifully the ingenuity of the architect. Its width at the base is about twelve feet, and it then tapers upwards, till the top has a thickness of only about three feet; but the slope is all on one side, and it is on that which is opposed to the stream; while the other side, which has no force to resist, is perpendicular; so that if it was carried up to a point at the top, it would form a right-angled triangle. Now this shape and these proportions are just those which the principles of mathematics discover as best fitted to offer the most resistance. Yet the beaver can know nothing of mathematics. Very few men even are sufficiently acquainted with them to work out the problem. What is the nature, then, of that mysterious something, which guides and impels this animal so unerringly to act upon the truest principles of the art?

Then, again, how should the beaver know when the water in the river or creek is subject to fail in the depth necessary for its purpose? For it does not build a dam where it is not necessary. This is a most marvellous prescience for an animal; but it cannot be supposed that the beaver traces the marks of the water along the

banks of the stream, and by its own observations thereon comes to the conclusion, that what it sees has been, will be again. This is the way man would get at it, were he a stranger to the locality, and had he no other means of knowing it. His mode of inquiry, however, and his ability to explore and put his observations together, in order to compare and reason upon his comparisons, require certain mental faculties with which no animal has ever been gifted, or ever will be.

The situation of the dam, too, deserves a little of our attention. The beavers first appear to select a spot on the northern bank of the river, in order to have the benefit of the sun on their houses, and then appoint the site of their breakwater; still they make no mistake here, such as that of constructing the dyke on the wrong side of their dwellings, where it would be of no use to them. Who or what is their engineer? Whoever or whatever it is, it never misleads them; and it is not a little remarkable that they should never build the dam out of its proper and most fitting place. They have no necessity to appoint one of their number that has been to college for the purpose of being trained in the art, to act as their guide and ruler, to take the superintendence of the structure, and the responsibility of the undertaking. The secret and infallible monitor has its seat in the very disposition of every individual beaver, with an equal degree of certainty and amount of force, and all agree at once to one plan, and in such a manner that one would think they had some particular method of understanding one another. They hit upon the right mode as if by accident; more wonderful, however, than the coincidence of two human beings falling upon the same design, for it is a concentration of coincidences from the distinct individuals of a whole community.

"No man," says Lord Brougham, "ever acted so as to make his operations chime in with another's, unless he either had previous concert with that other, or both acted under a common superior, and obeyed his direction; and then the joint operation was that of his superior. But suppose a man were compelled by some feeling he could not account for, and did not at all understand, to go at a given time to a certain place, and with such speed as to

arrive there at a given moment, and were to find another just arrived there, who came to meet him without the former previously knowing this, we should have a case similar to that of animals acting in concert, supposing them to do so."

It seems hardly possible to have the matter put better; but we think the similarity would have been more perfect and striking had his lordship substituted fifty men or more instead of two only, as he has; for, in some cases, many more animals or insects than the number we have suggested are found to act in the most perfect concert. The beavers must act in this way, for it is impossible that they can compass the ends of their marvellous operations; but what kind of mental consciousness—if any at all—these creatures have of their work while in the act of executing it, can never be determined.

We may observe here that the usual habits of an engineer, or an architect, either when planning or executing, are not, in the same circumstances, the characteristics of animals. In such cases, anxiety more or less, in proportion to the responsibility of the undertaking, distinguishes man, and that almost without an exception; but in no instance does the animal feel any, although its very life may depend upon the success of its measures. Man will rise early and sit up late, spending many of his hours that ought to be given to repose in troubled thought, in order to discover the best means of answering his end. His anxiety often exhausts his spirits, while his devotion emaciates his frame and breaks down his health. The animal never does any such thing. Its plans are formed without study at all, and its work is executed without anxiety at all. It is, properly speaking, neither depressed nor elated, yet always labours with cheerfulness, and is the subject of no harassing cares, because it is incapable of feeling the responsibility of ultimate consequences. Here, then, must be perceived a wide difference between rational man and the irrational brute; and, under the circumstances named, the animal appears to have the best of it, for it certainly acts the more rational part. In the latter case, it is the wisdom of the Creator acting

through Instinct; in the former, it is man himself who puts his own mind to applications of inordinate length and care.

One thing more remains to be mentioned concerning the beaver, and that, too, is a very remarkable one. Some branches of trees, as well as their trunks, are necessary for the proper construction of their dam, and the beavers here find work for their gnawing disposition, which innate quality, however, would be of no use to them had they no cutting tools suitable for such a purpose. Just these tools, then, are found in the four incisor teeth of these quadrupeds, which have them two in each jaw. "The incisor teeth of the beaver are broad, flattened, and protected anteriorly by a layer of orange-coloured enamel, the rest of the tooth being of a comparatively soft substance, where a cutting chisel-like edge is obtained, and indeed no edge tool, with all its combination of hard and soft metal, could answer the purpose better. In fact, the beaver's incisor tooth is fashioned much upon the same principle as that followed by the tool maker, who forms a cutting instrument by a skilful adaptation of hard and soft materials, in order to produce a good edge." So that He who gave the propensity to gnaw, must have been the same Being who supplied the animal with the most fitting instruments for putting it into use.

But the fact to which we wish to direct special attention here is the method the beaver adopts in the application of its cutting instruments for the purpose of answering its ends. It is well known that this animal fells the trees it requires for use by means of these sharp teeth; and we shall now find that the beavers seems acquainted with another science, and that not a simple one, at least it goes to work as if familiar with the laws of gravity. It begins the business of felling by gnawing round the base of the tree; but in order to save itself a great deal of work, and to overcome an otherwise insuperable difficulty, for it is necessary that the tree should fall across the stream, that it may float down with the current, the beaver operates mostly on one side, and that always on the right one, doubtless, without any previous experience, for there is no reason to believe that a young beaver would not do it as unerringly, and set about it with *as much readiness*, as the oldest of the family. The fact

that this singular creature should gnaw nearly through on one side, while leaving the other nearly untouched, without ever being in error as to the side taken, is as exquisitely curious as it is deeply mysterious, and must be the result of a purely instinctive faculty. The trees cut down are sometimes of the thickness of a man's body, and the beavers select those which stand up the stream, from the place of their habitations, not those below it, because, in the latter case, they could not haul them up against the current, although of this again they can have no experience, for they never try it.

In like manner, the branches of trees, which have been dragged from inland, they commit to the water above their dam, that these materials also may float down to it likewise.

So strong is the impulse of their building instinct that they cannot help yielding to it, even when there is no necessity for it, and this is a presumptive evidence that they know nothing whatever of its purport. Of the one brought to this country in 1825, Mr. Broderip gives the following account: —

"It would drag along a large sweeping brush, or a warming-pan, grasping the handle with its teeth, so that the load came over its shoulder, and advancing in an oblique direction, till it arrived at the point where it wished to place it. The long and large materials were always taken first, and two of the longest were generally laid crosswise, with one of the ends of each touching the wall, and the other ends projecting out into the room. The area formed by the cross brushes and the wall he would fill up with hand-brushes, rush baskets, books, boots, sticks, cloths, dried turf, or anything portable. . . . After he had piled up his materials in one part of the room (for he generally chose the same place), he proceeded to wall up the space between the feet of a chest of drawers, which stood at a little distance from it, high enough on its legs to make the bottom a roof for him, using for this purpose dried turf and sticks, which he laid very even, and filling up the interstices with bits of coal, hay, cloth, or anything he could pick up. This last place he seemed to appropriate for his dwelling; the former work seemed to be intended for a dam."

All the modes of working, then, adopted by the beaver, are purely instinctive in character. They prove too much for animal intelligence, since some of them suppose a large acquaintance with more than one of the abstruse sciences, and not a less amount of sagacity in applying them—an extent of knowledge, and power of sagacity, the former of which the large majority of human beings never acquire, nor are they endowed with an equal amount of the latter.

But what support can be gathered from the phrenological facts? Now the brain of the beaver, in proportion to the bulk of its body, is only $\frac{1}{290}$th; a proportion not nearly so large as that of the rat, which is $\frac{1}{78}$th. So that if the amount of nervous matter be allowed as any sort of criterion, and as a general rule we think it is, the rat ought to be a much more intelligent animal than the beaver. But where Instinct interferes with the standard, as it does in animals, in some more, in others less, no certain conclusions can ever be arrived at. Adopting, then, the rule, the facts support the belief that the operations of the beaver are the results of an instinctive faculty rather than that of an intellectual one. The brain of the beaver, too, like all other rodentia, is destitute of those convolutions on its surface which characterise this organ in man, and in some of the higher animals, but which especially mark the human brain.

The operations of the beaver, in the words of Lord Brougham, "are of great uniformity; all packs or companies of beavers, and at all times, build the same shaped structure, and resemble one another so closely in matters which are arbitrary, and therefore cannot be considered as the result of experience or reflection —cannot be dictated by circumstances."

This last affirmation, though from such high authority, is not perhaps strictly correct, for we have seen that the beavers do adapt the structure of their breakwater to the circumstances of the river. If the water maintains a uniform level, without being subject to fluctuations, these economical and apparently shrewd creatures build no dam at all; if the current be steady in its flow, they take it across nearly in a straight line; but if the motion of the water is violent or strong, they then make it into

a considerable curve. And what is this but an accommodating power of Instinct? As a rule, Instinct operates uniformly, but it seems, nevertheless, provided with a property that is capable of accommodating itself, within certain limits, to emergencies or accidental circumstances that may happen within the particular province the limits of which circumscribe the instinctive operations of any species of animals or insects, birds or fishes.

There are many other animals among quadrupeds, the habits of which are fraught with very great interest; but the beaver must be the last of our selection from its class, since all our space allotted to mammals is filled up, and we shall, therefore, next pass on to make a selection from the feathered tribes, which have habits of life not less amusing and curious than those we have already considered.

It will not be thought that we allow no sort of intelligence to quadrupeds, but we believe it is confined very much to those of them that are destined to become directly useful to man — those that he must teach, before he can guide and controul; such, for instance, as the elephant, the horse, and the dog. Had these been gifted with no kind of intelligence whatever, how could they be instructed? and without being instructed, what use could man make of them? It appears to us, therefore, that intelligence is given to animals only, or chiefly, in order that man may make them subservient to his purposes, and in amount sufficient only to answer his ends. The animals of purest and strongest instinct cannot be taught, and such are those to which instruction is not necessary; they serve man's use best by the force of their Instincts.

CHAP. XI.

Instincts of Birds. — Their Brain. — The Stork. — Striking Habits. — Mode of Travel very singular. — How deals with other's Young. — Instinct in a Cage. — Hen's Instinct. — Her curious Conduct. — Ostrich's Instinct. — Her remarkable Neglect. — Her Stupidity. — Heron. — Her mode of Fishing.

THE total bulk of the brain of birds, compared with the weight of the body, is not less than that in the mammalia. Its surface is destitute of those convolutions or eminences which form such a prominent feature of the human brain; nor is there any *corpus callosum*— fibres of white matter — uniting the hemispheres; and the cerebellum, moreover, is large. In some of the smaller birds, as sparrows and canaries, the proportion of brain exceeds that in man; for in the latter birds it amounts to $\frac{1}{14}$th of their bulk, and to $\frac{1}{25}$th in the former; but this is accounted for in consequence of the large quantity of medullary matter required for the origin of the nerves; and besides, the cineritious matter forms but a small portion of the brain. The cineritious, glandular, or secretory part is of a greyish-brown colour, and surrounds the inner portion of this remarkable organ. The optic thalami are, however, voluminous.

The birds of a migratory character shall have first attention, and these creatures of God's creative wisdom afford to man examples as instructive as their instinctive impulse is curious and interesting. They engaged the thoughts of the ancient poets and philosophers, as well as those of the inspired penmen of old; and they are worthy of the consideration of every philosophic mind of the present day.

Jeremiah thought it strange that the fowls of the air should be wiser than the people of the Lord, yet so it was, and so it still is. The fowls of the heaven, the fishes of the sea, the cattle upon a thousand hills, and every creeping thing upon the face of the earth, live in obedience to those laws which, with infinite wisdom, their Creator has stamped upon their constitutions. But

man, though made superior to all else, and placed at the head of all, alone rebels. Let the prophet himself speak: "The stork in the heaven knoweth her appointed times; and the turtle and the crane and the swallow observe the time of their coming: but my people know not the judgments of the Lord."

The Stork.—This sombre and apparently melancholy being, so remarkable for its gravity and mournful visage, is, like the swallow, a bird of passage. Storks make their migrations in large flocks. Spring is the time of their arrival in Europe, and though they rarely visit Britain, they do yet find their way to Sweden and to the north of Russia; and though common at Seville, they are seldom seen at Rome. As winter approaches, the travellers return to seek again the more genial climes of Asia and North Africa, but that of Egypt more especially. They are welcome guests to the inhabitants of the marsh and the low countries, where frog and reptile abound, for these scavenger birds clear the land of all such nuisances, the living and the dead both. Hence in Holland they are a privileged race, receiving protection from the laws. The Dutchman erects a false chimney, and the German a platform, as sites for the building of their nests; while the birds themselves make choice also of turrets and steeples for the same purpose, and compose the nests with sticks and twigs, and line them with reeds, grasses, and moss. When tamed, they may be seen stalking unconcernedly about the streets and market-places of towns, and clearing them of all putrescent substances, such as offal and entrails, which are often scattered about the thoroughfares of the people, who are not particularly nice as to the consequence of the invisible but not less noxious effluvia.

In Egypt the fields and meadows are sometimes seen to be quite white with living storks, and Dr. Shaw, while journeying over Mount Carmel, was there a witness to one of their annual migrations from the valley of the Nile, and states that the three flocks he saw pass over were half a mile in width each, and occupied the space of three hours in passing. At no other time are they seen in flocks but those of assembling for starting and for returning, and those of making their aërial flights

to and fro. It is, too, with unerring sagacity that they return to the same spot formerly occupied by them, as well as to the same nests they quitted the previous year, and manifest much joy in again taking possession of their deserted steeples and turrets. Unlike the crane, the storks seems incapable of producing any vocal sound, and all the noise they make is a peculiar snapping clatter, which results from the concussion of their mandibles.

But the most striking of the storks' habits, and those which involve the points of special interest to us, not only because they are proper to our subject, but because they are so strangely curious, are to be found in their mode of assembling together before setting out on their journey homewards, and in the peculiar method by which that journey is executed. Some considerable time is spent in preparation for the aërial voyage. The thought of it—if the expression may be allowed—seems to put them into a great deal of excitement, especially as the time of departure approaches, which is about the beginning of September; and though silent at all other times, they now begin to pour forth a most singular clacking with their bills, as if debating the method of going home, or the time of starting, or as if they were making inquiries as to whether the whole flock had come in, or which were missing, or when all would be ready. For, and it is worthy of special remark, the journey is not commenced until all the storks of a whole district have been collected together, so that none be left behind after the hour fixed upon.

What, then, is the method by which these birds know, or appear to know, when all their numbers have arrived? Should one of a large flock be absent, can they be really conscious of it? They seem to act as if they were, for none depart till all are in. For many days previous to their setting out, their place of meeting is like the breaking up of a camp, only longer delayed; the whole body is in commotion, every individual in full bustle, and the multitude of mandibles, all striking quickly and forcibly together, produce a clatter as extraordinary as the scene is mysterious and interesting. It is plain that no philosophic explanation can be given to these remarkable motions and noises. The cause, the

spring of the movements, lies too deeply hidden in mystery for any power of intellect to investigate. Man's philosophy will not, cannot reach it. But everybody must admire the beautiful illustrations of an Instinct, though itself not understood, which is so nicely adapted to the necessities of a creature it so unerringly guides, and so precisely controuls.

At length the clattering clamour ceases, silence succeeds the general hubbub, and when everything appears settled, and all arrangements completed, the birds take to their wing in a body, as if every individual of the whole flock had been duly and particularly apprised of the moment of departure. We apprehend that it is by no method of communication from one to another that each stork comes to understand when that moment is at hand. Yet evidently none misunderstand it, for all are of one mind about it. They are able to distinguish it from that of taking an excursion for food. But why should they? Not one, not even those that have never experienced it, is in doubt as to what is about to take place. There is not the least difference of opinion about the time or the method, because there is but one director, Instinct, which acts simultaneously, and in all alike. But how this mysterious power operates, we do not pretend to understand; whether indirectly, by a law stamped upon the nature of the stork, or directly, by the continual superintendence of the Supreme Being. Our opinion adheres to the former plan, for the reasons we have already given, as being more consistent with our Maker's general mode of government.

Night is the time that storks mount upon the wing for the purpose of entering upon their journey; rarely, therefore, can their manner of arranging themselves be witnessed, or it would be a spectacle of no ordinary interest. It seems, however, that it is done without noise or confusion, and ascending at once high in the air, they form their numbers into a sort of an open triangle, thus, ∧, in order the better to cleave the atmosphere. The position so assumed is the one best fitted to cut the aërial element with the greatest ease and rapidity; although the confirmation of the birds appears very constrained, for every head and neck is directed straightforwards,

and all legs are extended backwards. The leading bird, which divides the air in advance of the others, or that at the apex of the triangle, has the hardest place, and even this seems to be fully understood by them, for the post is held only for a time, when the head stork turns off and falls in quite at the rear, while the succeeding bird immediately takes its place, and presently the same thing will be repeated, so that every individual takes its turn at the most arduous duty. This is a most extraordinary arrangement to be made by animals, and our curiosity prompts us to ask, how do these creatures discover that the apex of the figure is the most difficult place? Then again, that being understood, by what method do they agree to take it in turns? Further, how does the bird filling it know when it has done its duty, and the time to relinquish it? How are all these things managed by them? These are questions in the highest degree curious, but they cannot be answered.

It is said of the cranes, which take their flights in a similar manner, that when the wind becomes violent, and threatens to break their ranks, they throw their lines into a circle; or if an eagle is about to attack them, they adopt the same manœuvre, and it is supposed that the storks have recourse to stratagems of the kind under like circumstances.

The instinct of affection for their young is remarkably strong in the storks; and if the following account from Brown's anecdotes is correct, they are a little more acute in distinguishing their own young from those of other birds, than are some well-known others of the feathered tribes. "At Smyrna, storks have become very familiar, and build their nests on the tops of houses, and other elevated situations. The inhabitants take particular delight in amusing themselves at the expense of the life of the poor hen birds. This is by taking away some of the stork's eggs from the nest, and replacing them by those of the common domestic fowl. When the young are hatched, the sagacious male bird discovers the difference of these from their own brood, and sets up a hideous screaming, which excites the attention of the neighbouring storks, which fly to his nest. Seeing the cause of their neighbour's uneasiness, they simultaneously

commence pecking the hen, and soon deprive her of life, supposing these spurious young ones to be the produce of her conjugal infidelity. The male bird in the meantime appears melancholy, and bemoans her loss, though he seems to conceive she justly merited her fate for bringing disgrace upon her family."

The intensity of the migrating instinct is very great, and no better, nor more striking proof of it, can be given than what has been furnished by storks when confined in a cage. The illustration is marvellously curious, and remarkably precise and marked as to the time of its development. Previously to the period of migration the stork in captivity has no fault with its prison, nor kicks at its confinement, but is very quiet, and apparently quite contented. The moment, however, the time appointed for departure arrives, the bird can be at peace no longer. Some strange impulse has awoke within it, and exerts an irresistible influence. It is more like the spirit of inspiration than any other thing to which we can liken it, and operates, we should say, in a manner very similar to that power which urged the prophets to speak, more particularly on those occasions when they were made to foretel events they did not clearly comprehend. The author of both powers is one and the same Being. The mysterious instinctive faculty begins to operate at the proper and fit time; and though invisible as the wind, its rising is irrepressible, and its indication unmistakeable. The stork neither sees it, nor knows what it is. The bird, however, has no means of resisting it, nor inclination either; but when the internal monitor admonishes, the captive, for the first time, seems to feel that she is a prisoner, and in her struggles to obtain freedom, in order to obey the voice of her Instinct, she dashes herself against the bars of her cage, and ceases not till every spark of her life has been extinguished by the force of her own efforts. Such, then, is the power of this wonderful Instinct.

Verily there is a power, too, in the Spirit of the Lord, but felt only in the hearts of those who fear Him: "The wind bloweth where it chooseth, and thou hearest the sound thereof, but canst not tell whence it cometh, and

whither it goeth; so is every one who is born of the Spirit."

Though the instinctive faculty in animals is invisible, it is yet plain that it is operative. The Spirit of God is invisible, but nevertheless not inactive. It is given to purify the innate corruptions of the human heart, and it becomes man to seek it by earnest prayer at the hands of Him who alone can give it. Without His refining influence, there can be no christianity, and consequently no salvation. Forms and duties and ceremonies are all vain, where the heart is not under the mysterious and holy influence of the Divine Spirit.

The common Fowl.— A farm-yard hen, unlike the stork, can be cheated with strange eggs and young easily enough; nor does she ever afterwards discover the trick. She and her progeny have the greatest dread of water, while her brood of tiny ducklings venture in with the utmost delight. In the greatest distress as to what will become of the strange little adventurers, the foster-mother chucks all round the margin of the pond. She calls them off, warning them of danger, and trying to alarm them; but they heed none of her cries; her anxious tones do not affect them, nor are they understood by them. She wanders from point to point as if she thought some unaccountable fate had taken possession of her offspring; and though she can swim, she never makes an adventure in the water after her brood; her aversion to that element is greater than the Instinct of her affection. Notwithsanding all these glaring inconsistencies of the little strangers, the hen still makes no detection of the fraud. She continues as stupid as ever about the matter. She obeys her Instinct without knowing why. She is unacquainted with the object, and she cannot distinguish the means.

The habit of the hen bird in sitting upon her eggs to bring forth her young, like many other wonderful things, is so common that it fails to arrest the attention, and to excite the admiration, of those persons who are the most familiar with it. How true is the remark made by Paley, that "It is difficult to resuscitate surprise, when familiarity has once laid the sentiment asleep."

Yet the fact of the hen having a disposition to sit *upon her eggs* with so much patience and tenacity as

she does is a truly wonderful phenomenon; and if it could be explained on any intelligent principle, it would involve the knowledge of more than one particular branch of science. On the supposition, for instance, that it was founded upon reason, the hen must necessarily know, first, that the eggs will produce her young, for she insists upon having them, or something like them, underneath her; secondly, she must know that a certain amount of heat is necessary to mature the chick; thirdly, that her own body will supply and impart it to the eggs; and lastly, that this heat must be continued during a certain length of time without an interval even of sufficient length to allow of their cooling. Now seeing that the hen is too much of a simpleton to be able to distinguish between a piece of chalk and one of her own eggs, or between a duckling and a chicken, nobody will be disposed to believe that intelligence is the source of her actions, or that it has anything to do with them, and consequently she can have no knowledge whatever of any one of the particulars we have named. If she could understand one thing, she could understand another that was not more difficult; and if she could reason upon one thing, she could reason upon another that was not more complicated.

That the sitting hen, when having left her nest occasionally for food, should always make it a point to return to it, whether she has been successful in finding a sufficiency of nutriment or not, or whether any at all, before the cool air has had time to abstract from her eggs heat enough to do them damage, is, perhaps, the most marvellous feature in the whole process. Her anxiety to return is made strongly manifest. Her instinctive propensity to be upon her eggs is more intense than the desire to gratify her appetite. It is too much to suppose that she knows for why, or that she is not quite blind to the end. Were she to stop away only once simply long enough for the external cold to deaden the chemical and mysterious process generated by the heat within the eggs, the object of her sitting would be completely frustrated. But she cannot know this; yet she acts as if she did. Intelligence is wanting to her; she therefore has no means of knowing it. As

the same time no intelligence, however exalted and pure, could guide the hen in the use of the means to her end, more unerringly than she is guided without a seeming particle of an intellectual faculty.

Her conduct, then, cannot be explained upon any principle of intelligence, but it must assuredly be the promptings of a pure and infallible Instinct. The hen does exactly and precisely what the delicate process requires, without knowing anything of the nature of the process, or its requirements either. How marvellously nice is the adaptation between the impulse of her Instinct, and the duties necessary to accomplish the object designed! It is quite plain that there is but one Being from whom such things can emanate, but how He carries on the operations is not plain. He, in His wisdom, has not seen fit to reveal it. But let us be content, and admire all that *is* clear about it.

In like manner act other birds; but in one instance the Instinct has been observed to accommodate itself to circumstances, and this leads us to notice

The Ostrich—which furnishes the example. This bird has a wonderful Instinct of providing a different kind of food for her young, when just hatched, from that which they live upon subsequently, and from that which she takes herself. The fact presents a very curious phenomenon; nevertheless, not altogether unique, in principle at least, in the history of animals, as we shall hereafter point out.

"In our way over the plain," says Mr. Burchell, "we fell in with an ostrich's nest, if one may call a bare concavity scratched in the sand, six feet in diameter, surrounded by a trench equally shallow, and without the smallest trace of any materials, such as grass, leaves, or sticks, to give it a resemblance to the nests of other birds. Within this hollow, and quite exposed, lay twenty-five gigantic eggs, and in the trench nine more, intended, as the Hottentots observe, as the first food of the twenty-five young ones. Those in the hollow, being designed for incubation, may often prove useless to the traveller; but the others on the outside will always prove good and fit for eating. In the present instance, the whole number was equally good." Some-

times several female birds unite, and then sixty or seventy eggs will be found in one nest, and monsters they are, for one ostrich's egg is equal to twenty-four of those of the common barn-fowl, and contains as much as five pints of liquid.

It is no parallel to say that the young of the mammals are provided at first with nutriment that they do not afterwards have or require; for here the mother, though she brings forth their milk, it is yet secreted in a manner over which she has not the slightest controul, either directly or indirectly. But the act of the ostrich in laying some of her eggs on one side, in order to have their nutritious qualities preserved and ready for her newly hatched and tender brood, is just what a knowledge of the particular qualities of the eggs and wants of the young would suggest, and just what reason would dictate; since the old bird appears to have a deliberate choice in this business. Yet, in truth, she can no more know that her eggs are more digestible and nourishing, therefore the better adapted to the powers and wants of the little one just escaping from the shell, than are stones, and pieces of leather and iron, which she herself will often swallow. Still she does the right thing; and, could it be known, the probability is, that it would be found that she adopts the only safe means of rearing her offspring, and the most direct for accomplishing the end to be answered.

But the fact worthy of special mention is the adaptation of the ostrich's attention to the duties of incubation, according as the variation of climate facilitates or retards the chemical operation. In Senegal, where the heat is excessive, the ostrich leaves the operation to be sustained by the rays of the sun during the day, but returns at night to her eggs, in order to perform the functions of the maternal office in person. At the Cape of Good Hope, however, where the sun's power is too weak to be substituted in her stead, the ostrich there conducts the business like other birds everywhere, and sits upon her eggs both day and night. What curious thing is it, then, that teaches her that she must be constantly assiduous in the one place, while she may be partially neglectful in the other? For she makes no

mistake in either case. She goes away only when there is the presence of some power to carry on the process of incubation without her, and that power, too, is an invisible substance. She returns, moreover, at a moment when her substitute withdraws its influence, and when her further absence would be productive of mischief to the chemical process going on within the eggs.

We ask here, how does the ostrich know that heat is at all necessary to the operation? and further, that its supply must be constant? but more especially, and this is truly marvellous, how does she distinguish the very degree of heat required? In the South of Africa, she acts as if she was fully aware that the heat of the sun there was not of sufficient power for the purpose; she therefore never trusts to it. She cannot know it by experience, for she never makes an experiment. But she behaves as unerringly as if she was guided by the record of a standard degree of heat that had been obtained for the incubatory process, and as if she acertained the degree of the sun's power by a thermometer, and could judge, with all the certainty and nicety of the instrument's measure, when it was in deficiency. These things must either be results of a very strong reasoning faculty, or of an accommodating property of Instinct. We admit the latter alternative, and exclude the possibility of any explication from the former.

If the intellectual principle be adhered to, it must be granted to the ostrich on a large scale, for no small amount of intelligence will be sufficient to give an explanation of her conduct. The facts display some very correct reasoning from premises, based upon particular knowledge.

Now it is well known that the ostrich is rather a stupid animal; at any rate, not in the least remarkable for any degree of sagacity. It is even said that, when pursued, the ostrich, instead of running ahead, like the fox, performs the flight in circles, thus giving to her pursuer the advantage of taking a shorter course. Nor, in a physical point of view, will the argument support the belief that this bird has much strength of intellectual faculty; for in proportion to the size of her body, the head is extremely small, and, moreover, very flat; so that the

organ we consider as the seat of that power must be exceedingly diminutive likewise. Whether anything can be said on the score of quality, we cannot tell. But the brains of the ostrich were considered a choice delicacy by the Romans, and formed one of the luxuries on the profusely spread table of Heliogabalus, who had them scooped out from hundreds of these birds' heads at a time for the purpose of a licentious feast.

The Heron.— We shall stop to notice one instinct only of this bird, and that is one not a little wonderful in its character. It is generally known that fish are alarmed at shadows upon the water, especially at those in motion; but this is the case more particularly with the trout and salmon tribes. They dislike to approach a shadow at rest; but when disturbed by one in motion, they dart away as if with fright into the deep, and return to the spot only after a lengthened period. Now the heron seems familiar with the habits of such fish, and shapes her conduct accordingly; for she fishes only in the absence of the sun, when there can be no shadow to frighten away her prey.

Such being the case, this "bird alights in a quiet way, then wades into the water to its depth, folds its long neck partially over its back, and forward again, and with watchful eye awaits till a fish comes within the range of its beak. Instantaneously it darts, and the prey is secured." It is not surely from knowledge that the heron fishes at the right time; for, if so, she must obtain it by experience, and this we think a task too much beset with difficulties for this or any other bird to accomplish. If the old ones only did it, and the younger not, the supposition might be entertained; but the great probability is that all act alike, and that the young adopt the practice with as much readiness and apparent sagacity as the oldest and most experienced among them. We put it down, then, as the marvellous working of an instinct — an instinct most admirably adapted to the circumstances of the necessary method made use of by the heron to obtain the means of subsistence.

But there is another characteristic in the habits of the heron's fishing that makes the fact still more particular and marked. On occasions when a river has inundated

the marshes and plains of its basin, and the floods have subsided, leaving here and there some pools of water with fish in them, which had not been able to return with the volume of the rolling element, then it is that the herons fish in sun and shade indiscriminately, as if they felt quite positive that the alarm caused by a shadow could then be of no consequence, since it was no longer possible for their prey to escape them. The fish are in peril, and the herons, seemingly aware of it, pounce upon them without taking that peculiar precaution which characterises their manner of doing it in other and ordinary circumstances. "How," says the writer in the British Naturalist, "the herons find out these occasions it is difficult to say; but we have seen several pairs come after a flood to a river, which they never visited upon any other occasion, and within many miles of which a heronry, or even the nest of a single pair, was never observed."

CHAP. XII.

The Swallow Tribe. — Nicety of Migratory Instinct. — Anecdote of Napoleon. — Freaks of the Swift. — Nest of the Martin. — How built. — Does the Martin make Reflection? — Curiosities of Nests. — The Blackbird's. — The Thrush's. — Their Masonry very curious. — The Magpie's Fortress. — Finch's and Linnet's. — The tiny Wren's. — Tomtit's. — Hummingbird's. — Marvels of Nests. — Why Eggs oval. — Birds acting as if directed by Reason. — Migration of Quails. — Sea-gulls no need of a Mariner's Compass. — Carrier Pigeons. — Their wonderful Feats. — Instinctive Concert. — Language of Animals.

THE first appearance of swallows may be said to signalise the opening of spring, and thereby to gladden the hearts of all who welcome the coming of both. It is a handsome, clean, and lady-like bird, and is emphatically an inhabitant of the air, for it is extremely little that it has to do with the earth. It seems fitted for a more refined existence, and finds its principal home in the "bright blue sky and the lofty pathways of the air." Being the most purely and exclusively in-

sectivorous of birds, it is peculiarly fitted for the aërial chase.

"There," writes the author of Popular Natural History, "do these happy birds sport and wheel, in their full felicity, for hours, floating without effort in that rare expanse, which others of the feathered tribes use chiefly as a highway, and not a home. No birds touch the earth so rarely as the swallows, and for this aërial life their structure is beautifully adapted. Look at one as it comes sweeping along the village road, within a few inches of the ground, which it touches not, and passes close by your person, as if conscious of your inability to harm or seize it during that arrowy flight. Watch the bird with a keen eye, for there is little time for observation with such a winged machine. Did you mark the shape of its body? What work of human science does it most resemble? See how full the fore part of the animal is, mark how it tapers gradually towards the tail, and then remember that such is the principle upon which the fastest sailing ships are constructed. The wings resemble oars of great power, and are moved by muscles of singular force, whilst the long-forked tail supplies a never failing rudder to guide this bird through those numerous windings in which it delights. The food is seized during flying, and this requires a peculiar construction of the mouth, and also the keenest powers of sight. We accordingly find that the swallow's mandibles open as far back as the eyes, thus producing a large gape, in which insects are caught as by a net."

The migratory character of the swallow tribe constitutes their claim to be considered as forming a part of those oracles of nature, which declare the will of the Deity. The time of their arrival here in the spring is determined by the season, according as that is sooner or later. The sun must first awaken up the life of insects, and bring them forth from their lurking places, ere these interesting birds can find the means of their subsistence in this country. But there is no uncertainty about their coming, and not much irregularity in the times of their arrival and departure. The following dates, according to Mr. Markwick, are the averages

deduced from a computation that extended over more than a quarter of a century: —

Swallow, first seen, April 18th.; and last seen, October 31st. Martin, first seen, March 4th; and last seen, October 16. Sand-martin, first seen, March 26th; and last seen, September 12th. Swift, first seen, May 9th; and last seen, September 3rd.

It sometimes happens that a few stragglers arrive before the spring has fairly opened; and if it again sets in cold, these forerunners are found missing, and it is supposed they retrace their flight to warmer latitudes, and return with the great body of their companions. Hence the proverb, "one swallow does not make a summer." But the fact itself looks a little like a precocity of Instinct.

They spend the summer happily on the wing, rear two broods; and their business being then done here, they prepare for the passage back to Africa, there to pass the winter in a warmer climate than we can give them in our northern latitudes.

The swallow, like others of its tribe, finds the same locality in which it was reared, or in which it has previously taken up its residence, and the revisit to its old haunts seems to afford it considerable delight. The tiny traveller has to discover its way over a space of several hundred miles in extent, yet there is no reason to suppose that it ever loses the road, or fails to reach the spot of its previous habitation. But analogy leads us to the belief that the bird takes the most direct and shortest course without being guided in the least by any power of observation it had brought to bear in the preceding year upon marks of a topographical character.

That this bird, or any animal at all, should be able to find its way over such immense distances without trouble, without doubt, or hesitation, and without error, involves a something we cannot understand; however, we may put ourselves to the puzzle by an attempt to peep into the secret. It is truly one of the Creator's secret things; and though we may wonder much at the marvel, and admire it too, it plainly becomes us to leave it as we find it. It is the mystery of Instinct.

The act of starting, too, by these birds for the northern

countries, brings out another curious question, and that is, how do they know when the proper time for setting out has come? In all the more wintry countries, such as England, there is something to determine their departure. The approach of cold, and the diminution or extirpation of insect life, might either of itself be considered sufficient to dictate the event. But in the northern and central parts of Africa, where neither of those causes can be of sufficient power, what is there then in external objects, first, to create the wandering disposition in the bird, and afterwards to form, at the fittest moment, the resolution to execute the project? Yet both these things happen at the right time; and, with the exception of the trifling precocious instances we have mentioned, no mistake whatever is made. The impulse to go is so intensely strong that no exposure to hardship, such as the risk of famine, nor the dangers of fatigue, in consequence of the length of the passage, nor the threatenings of adverse winds, which they have sometimes to encounter, are ever able to exert an influence powerful enough to deter by anticipation the effort of entering upon the journey, or to compel them to return when once it has been commenced. They *must* persevere, though death arrest them on their way.

At length autumn creeps on, when the old birds of the swallow tribe must go back, and when their young ones must go also to visit a country they have never seen before. That the latter go because the former do, cannot be granted, for there are facts upon record that furnish its refutation. The young broods will set out, they know not whither, at the time appointed, though there is not a bird of experience, or one that has made the voyage before, to accompany them; still the young adventurers act with as much unerring sagacity, as to the right direction and so forth, as do those which have already performed the journey several times over. What is there, we ask, to induce these inexperienced creatures to take at once the south any more than the north? Nothing surely that they can discern externally, such as any signs of direction above them, or the configuration of the earth below them.

It is said of Napoleon that he went, on one occasion,

to explore in person, with a body of troopers, some particular part of the Red Sea, and night coming on, the whole reconnoitring force lost their way in the water; but the great man of master mind, instead of giving way to despair, though the danger of being drowned was imminent, ordered, as if by an instinctive faculty, the horsemen to form a circle round himself, with the head of each horse turned on the outer circumference of the circle, of which he stood as the centre; that being done, he directed every man to proceed straight ahead until he reached the animal's depth, when he was to halt, and he that found the water becoming shallower was to keep on, and lead the way out. By this wonderful instinctive manœuvre, Napoleon saved himself and his force, in all probability, from a watery grave. But the birds we are speaking of never make a like experiment, flying round in a circle of many miles in diameter, to discover in which direction the warmer climes are to be sought. They require to put out no such feelers; yet of the four cardinal points, they always hit upon the right one.

Nor do the swallows, any more than other migratory birds, lose their way upon the wide waters. It is all the same to them whether or not the clouds cover the face of the sun, or hide the pole star from view. They are adventurers upon the expanse of the ocean, without a single available external index to guide them in the path of certainty. No light from the heavens can instruct them, no sight from any aërial height can direct them, and no sound from shore can reach them. How completely at sea, then, must these little creatures be, when they are found hundreds of miles from any coast, with no visible object to conduct them through the air above the trackless deep. But within every bird there is an infallible monitor, which steers each in common along the course that leads straight to the place of their destiny.

It may be asked further, how do these migratory birds find their way at all to the Western Isles? For they do not follow the land, and cross the channel at the shortest passage, but boldly venture on a long voyage, and search for land where it is not possible for them to know any is to be found. But such are, and ever will be, the marvels of Instinct.

When the swallow tribes are about to leave the northern countries for the more genial climes of the south, they have a method of preparation for it peculiar to themselves, and do not go off by solitary individuals, nor by pairs, nor by families; but they convene their assemblies, and depart in flocks. How is this done? Who or what appoints the time and place of their meeting? Instinct gives the answer, but refuses an explanation.

A few days previous to their departure, these birds appear to delight in some freakish exercises; but perhaps those of the swift are the most amusing, "which," says Mr. Couch, "usually takes its flight in the first or second week in August—the whole colony commonly disappearing at once—the actual departure being preceded, for a few days, by exercises in flying, which seem to be practising in sport what they soon expect seriously to be obliged to execute. They may be witnessed ascending in a spiral manner, and in very close phalanx, with even more than their usual rapidity, at a very great height; and having two or three times executed this movement, they suddenly sink down to their nests; after which, until the next day, they are no more seen."

The writer in the Encyclopædia Britannica describes their freaks thus:—"We doubt not that during every summer evening in which these sable creatures pursue their gladsome gambols through the unresisting air, they travel many hundred miles. It is easy to observe, that they are often on the wing incessantly for hours together, careering in fine weather in vast and intersecting circles, screaming after each other in no melodious strains, and flying at such a maddening rate as if flight were the only faculty worthy of exercise in earth or heaven."

The swallow builds its nest in this country about two or three feet down the shaft of a chimney, and the martin under the eaves of a house, and perhaps no better description of the latter bird's masonry work, and its method of rearing the structure, can be penned than that which has already been done by Mr. White. "The crust or shell of this nest seems to be formed of such dirt or loam as comes most readily to hand, and is tempered and wrought together with little bits of broken straws, to

render it tough and tenacious. As this bird often builds against a perpendicular wall, without any projecting ledge underneath, it requires its utmost efforts to get the first foundation firmly fixed, so that it may safely carry the superstructure. On this occasion the bird not only clings with its claws, but partly supports itself by strongly inclining its tail against the wall, making that a fulcrum, and, thus steadied, it works and plasters the materials into the face of the brick or stone. But then, that this work may not, while it is soft and green, pull itself down by its own weight, the provident architect has prudence and forbearance enough not to advance her work too fast, but by building only in the morning, and by dedicating the rest of the day to food and amusement, gives it sufficient time to dry and harden. About half an inch seems a sufficient layer for a day. Thus careful workmen, when they build mud walls (informed at first perhaps by these little birds), raise but a moderate layer at a time, and then desist, lest the work should become top-heavy, and ruined by its own weight. By this method, in about ten or twelve days is formed a hemispheric nest, with a small aperture towards the top, strong, compact, and warm, and perfectly fitted for all the purposes for which it was intended."

Here, again, we see that the bird does the right thing without knowing why she does it. She cannot judge from sagacity of the consequence of too much haste in her work. No one will admit the hypothesis of such judgment. Neither can she know it by experience, for the experiment, as such, is not made at all. Even to suppose it was, the difficulty would not then be got rid of, only shifted. Let it be granted, for instance, that she worked hard, and threw up her nest with the utmost despatch, and finally saw the whole structure give way, and broken to atoms and scattered upon the ground before her own eyes — what then? Could she bring reflection to her aid, in order to find out the cause of the calamity? Would it be at all likely that she could discover it by that faculty? Not in the least. We cannot tell when or where man himself became acquainted with the secret, but we may fairly presume that it gave him some little trouble before the principle became uni-

versally established. The small amount of intellectual power possessed by these birds must ever be considered inadequate to a task so difficult. Sagacity from knowledge, then, and the power of reasoning from experiment, are both insufficient to give an explanation to the phenomenon. It is the work of Instinct purely, and admirably adapted to the ends to be sought.

But in situations near the sea, the tide of which has covered the mud on the beach at the usual time of the martin's labour, this little creature has been observed to devote, in that case, the morning for collecting food, and postponed its work till the afternoon, when the material would be accessible to it, as if conscious that the waters would be ebbing at that time. Mr. Couch calls this the result of reflection and reasoning, and it looks very much like them, and so do all instinctive operations; indeed, they are the perfection of the purest reason; but we prefer ascribing it to the accommodating power of Instinct. This involves only the everlasting secret difficulty, and not the natural one; but the theory of intelligence involves both. Now we have opened the subject of birds' architecture, we will make here a few general observations upon it. And the structure of birds' nests furnishes a theme of no ordinary interest to all contemplative and pious minds—a subject worthy of the talents of the profoundest philosopher, and of the most sublime poet. Whether their work be made the object of study, or whether the purposes for which they are reared be considered, or whether they be looked upon as illustrations of the workings of a pure Instinct, they will be found in any one or all of these phases equally entertaining and instructive. And for examples, it is not necessary to rove abroad, either to the regions of perpetual snow, or to the sunny climes of the tropics; but we prefer confining ourselves, or nearly so, to our own country, and to select chiefly those instances that are the most common, and with which most people are familiar. A few facts, then, of actual occurrence shall first be presented, and the observations they may seem to court shall follow.

The nests of the larger birds need not specially detain us, because the apparent carelessness and looseness of their structure deprive them of that power to interest

the observer, which is such a marked characteristic of the smaller ones. It will be seen, however, that in the former the purposes of incubation do not require, as we shall endeavour to show presently, that particular care which is bestowed generally upon the nests of the more diminutive birds. Though the large birds do all that is necessary, yet they do no more. The work may be said to begin with the gigantic ostrich, the nest of which exhibits the essence of thoughtlessness, and the incarnation of idleness; and to end with the titmouse and the humming-bird, the architecture of which, on the contrary, displays an intensity of solicitude, and the most superb of workmanship. The one extreme of size is connected with the extreme of elaboration and beauty; while the other is associated with the extreme of unconcern and want of assiduity. And the gradation, however remarkable it may appear—and remarkable enough it is—proceeds regularly from one extreme to the other.

Let us take first, then, the nest of the blackbird, and that is one with which almost all persons have some acquaintance. The blackbird is among the first to commence incubatory operations; and before the wintry winds have ceased to whistle through the yet leafless hedges, this active and hardy bird has often completed her domicile, and even begun the second process. A thick-set hedgerow, an insulated bush, a dense evergreen, or a bower of ivy, generally form the sites of her choice, and all appear to be held in equal favour. Moss, small sticks, grasses, and fibres, compose the outer framework of the nest; while the inside is lined with some fine dry grass; and between this and the exterior is a coat of mud plaster of very neat workmanship, at least for such a creature under the difficulty of the circumstances.

The mud coating forms also a feature in the nest of the thrush, which suspends it upon the fork of a tree, in an orchard, or near a garden, that it may be somewhat under the protection of man against the attacks of the rapacious crow and magpie, which are always in wait ready to plunder and seize the eggs of it. This nest consists of a basket work of fine straws and grass, interwoven with moss and lichens, which also cover the

exterior, and within is a layer of clay mixed with decayed wood, beautifully smooth, and the circular proportions as regular as if the structure had been cast in a mould.

Now what is the object of the masonry coats which the two birds place round their nests? It is plain to reason, but quite hidden from the birds themselves. Both build early; they have, consequently, to encounter the last, though often not the least blasts of winter; it is necessary, therefore, to seek provision against them, and the coat of mud, clay, and rotten wood is the one that is provided, and anything more suitable is not, perhaps, to be found. What kind of knowledge, then, does the selection require? This can be answered only by looking into the necessary qualities of the material used. A stratum of something is wanted that will prevent the external cold absorbing the heat from the interior. Then it must be a non-conductor of heat, or nearly so. Nothing else will do. Accordingly these birds hit upon the best non-conductor for the purpose. Here is the table of the relative powers of certain bodies to conduct or carry away heat; or the proportional celerity, by which it will pass through them, and nothing can be more obvious, nothing more convincing. We exclude the decimal parts, and give the round numbers only.

Gold, with the speed of		1000
Platinum,	„	981
Silver,	„	973
Copper,	„	898
Iron,	„	374
Zinc,	„	363
Tin,	„	303
Lead,	„	179
Marble,	„	23
Porcelain,	„	12
Clay,	„	11

This table makes the case so clear, that scarcely anything more need be said. The dry and decayed wood, too, made use of by the thrush, is a non-conductor likewise. But neither of the two birds can know anything of that branch of the science of heat which relates to conduction. These creatures act blindly, then, in the

use of the means to their ends, and Instinct can be their only guide.

The Magpie, shy and cunning, takes some considerable trouble to form a nest, both in the selection of a suitable site, and in making it secure from danger. She is certain to make choice of the most thorny and thickest bush. This done, she begins some regular fortifications so as to render the bush doubly formidable. Hawthorn branches, with the sharp thorns projecting outwards, constitute the exterior of the impenetrable fabric; while the interior is lined with roots, hair, and wool; and if the animals from which these materials are taken are at hand, the audacious magpie will not scruple about plucking them from the backs of the living stock, with a wonderful deal of chattering while in the act of doing it. When the nest itself is thus finished, a strong bushy canopy, composed of the sharpest thorns put very compactly together, is erected above, leaving only a small aperture for the ingress and egress of the rightful owners. The defence is then complete, and forms a fortress that bids no vain defiance to every natural foe, such as the crow, the sparrow-hawk, and the kite. Such ever was, is, and ever will be, the architecture of the magpie, all ever adopting the same means and method precisely.

The Finches and Linnets build very neat, pretty, and lady-like nests. That of the common linnet is generally placed in some low bush, a furze if at hand, and is composed of moss, stalks of grass, and wool, and lined inside with hair and feathers. The goldfinch turns out a truly elegant little piece of workmanship, and such as must ever be an object of admiration to all examiners. Moss, lichens, dry grass, and wool form the exterior, and hair, the seed down of the coltsfoot, or down of the willow, line the interior. All is so neatly, so compactly, so beautifully, and so exquisitely put together, that no art or hand of man can rival or imitate it.

"The foundation of a goldfinch's nest," says Mr. Couch, "is laid with small leaves, moss, or fibrous lichens, and then so much wool is thinly and regularly drawn throughout as shall form a tissue of felt, which, by its contraction, binds all firmly together. I have known the

latter article fetched from a great distance; which shows how important is this web, in the bird's own mind, to maintain the stability of the edifice, when distended with the weight of an increasing family within."

The common Wren builds a nest of matchless structure also, and very large for such a small bird. The place of nidification chosen by this tiny creature is various, but generally under some thatched covering, in a cavity between the branches of a tree, amidst the ivy clustering round some old tree or wall, and very frequently in the side of a hay-rick. The shape of the nest is that of a domed edifice, with a small hole in the side towards the top, left for the purposes of a door-way. The material composing the exterior is varied according to the colour of the substance against which the nest is built, and this is a feature in the case not a little remarkable. If the nest is placed among the ivy or in the hay, it is usually constructed of green moss, for this is the colour that best answers the purpose of concealment in those situations; but if erected contiguous to some light coloured branches, it will then be formed of the grey lichens. The inside is lined with soft and warm materials, such as hair, wool, and an abundance of feathers.

The male and female both of these birds have been observed to collect the coarser materials in a heap before commencing the architectural operations, but the work of building has then devolved upon the hen bird only, while the other has gone in quest of the firmer substances that are fit to furnish the interior. And the labour of each seems, without debate, as perfectly understood as is that of a bride when she first enters her new domicile, and when she there assumes at once the presidency of the tea-table, without thinking it necessary to consult the bridegroom at all upon the question.

The Titmouse, or Tomtit, has special claims upon our attention, on account of its nest, which is an object of extraordinary beauty and interest; indeed, it is a most magnificent piece of workmanship, and extremely elaborate. Here also, as in the case of the wren, the female bird is the skilful architect. She generally makes choice of a thick bush for the purpose, and the nest is so

firmly fixed therein, and so closely woven with the main branch, that, in order to preserve the beautiful fabric entire, it is necessary to cut out the bush with it. It is of an oval form, of considerable length, and its dimensions altogether are disproportionally large for the tiny form that rears it. The aperture for entrance is in front of the upper part. A firm texture of moss and wool forms the exterior framework, which itself is covered with grey lichens, so nicely and so neatly put on, that the whole surface sparkles as if coated with silver; in short, it is exquisitely superb. Then, again, the inside is lined with such a profusion of the softest feathers, that it seems really choked with a superfluous abundance. Altogether it is a surprising and admirable structure, uniting all the purposes of utility with the extreme of beauty. No human hand can imitate it, and no machine produce a rival to it. The object of all this work, as well as of the kind of materials used in it, we shall presently inquire into.

It is not at all necessary for our purpose to traverse either the Pacific or the Atlantic for other illustrations, but we will just bring one from the intratropical regions of America and the West Indies; because the bird we wish to instance is still smaller than those we have selected from our own country. We refer to the humming-bird.

The delicate nest of this diminutive creature is only about one inch in diameter, and is not, therefore, so large as a hen's egg. The external parts of the curious little nid are formed of a light-grey lichen, and this substance, being produced up the branch or stem from either extremity of the nest, makes it scarcely distinguishable from those parts of the tree which support it. The small pieces of lichen that form the outer coat are so nicely arranged, and in such compact order, that they really appear as if glued together, if they are not actually done so by some kind of saliva or other. The inside layer consists of the fine down of flying seeds, and of silky fibres obtained from various plants, and all extremely soft and delicate; and between the inside lining and the exterior is a layer composed of some cottony *substances*. Such is the size, and such the construction

of the fabric this tiny bird builds for its nest. Its eggs are but two in number, and incomparably small, for the size of a pea is the measure of their dimensions.

The facts before us suffice to furnish two or three interesting topics of remark, and the first is the uniformity of structure maintained by all the birds of the same species. This is an illustration of Instinct of emphatic purity, and attended with a marvellous witness. The pattern is handed down from generation to generation, with neither a defect, nor an addition. The original is still preserved the same, no experience has improved it, and from time immemorial there has been no carelessness to degenerate it. It for ever excludes all new inventions, because none are wanted; the thing was made perfect at the first; it requires, therefore, no improvement, and the bird which built the very first was as wise as the one which has built the last; and the modern architect is no better informed or more experienced than the ancient.

Curious enough is this phenomenon, for the birds of the same species do not teach one another, nor do the old ones communicate the secret to their young, inasmuch as those which have been reared under a strange and foster bird, and consequently have never seen or been in company with their own parentage or with any of their species, will build after the very identical motto, without the least deviation from the original, and no other figure can they describe, nor do they ever attempt another. What strange thing is it, then, which impels the bird to adopt just one plan, and no other, and that just the right one?

It must be observed, too, that it is not the configuration merely that is adhered to with such wonderful tenacity and correctness, but the size is the same also, and the proportions given with the same surprising exactness. This particular is most striking in the tomtit and the wren, because their nests are so much larger in proportion to the birds themselves. Yet every tomtit and wren of the present day will have the same bulk as had their ancestors of primordial date. They must have it so; neither greater nor less can it be. Not only so, but the materials, under like circumstances, are the same

also, and, moreover, the different substances are placed in the same order. All these particulars involve a method of proceeding so unlike those which are adopted by human reason, that it strikes one, by the force of its peculiarity and of its enigmatical character, with astonishment. Man has discovered the art of building by the application of his reason to the results of his experience. The perfection of his architecture, or the point of his present attainment, has been arrived at by a very slow process—a process that has run over 6000 years. Boughs and branches of trees formed probably his first hut, and this was his starting point. From this primitive extreme his experience has been accumulating, and is now to be gathered from the various monuments of the past, as well as from all the written testimony ever made upon them.

But there is no written record, nor monumental pattern to guide the bird. Man, again, adheres to no uniform model, to no definite dimensions, nor to any particular materials; but all are as varied as the several architects engaged in the art. Human reason has no settled plan, but it shifts its plans, sometimes in obedience to a fanciful taste, while at others it refuses to go an inch beyond the limits of parsimonious utility. Reason, then, has unlimited choice of both plan and method; but Instinct has none in either.

Herein, therefore, lies the exquisitely curious, the great hidden mystery. The bird appears to be at the most perfect liberty to choose any course, to select any site for its nests, to gather any kind of materials, and to make the building of any shape and size; yet we see that this is not actually the case: on the contrary, the animal is evidently confined to one thing in each of these particulars, and the power that controls it is nothing external and visible, but some secret influence residing in the bird itself, and operating in a manner quite unknown to any mortal being, and for ever undiscoverable by human intelligence. "Have birds any notion of equality, or do they know that heat is necessary for incubation? No. In all these operations men recognise the intentions of nature; but they are hid from the animals themselves, and therefore cannot operate upon them as motives."

We have already intimated that the physical structure

and habits of the huge ostrich do not present a more striking contrast to those of the little humming-bird, than does the nest—if we may call it so—of the former, to that of the latter; and this wonderful difference between the one extreme and the other forms another topic of consideration; and being fraught with the deepest interest, it is deserving of particular attention. Our observations upon it, however, must be few, and we regret abler hands should not deal with it.

It has been seen that the nests of the smaller birds are more carefully wrought exteriorly, and more richly furnished within, than are those of the larger species. We have, therefore, to inquire into the object of the soft feathers, the cottony down, and the silky substances, that so pre-eminently distinguish the nids of the former from those of the latter. And here will be found a very remarkable adaptation of means to an end, but means over which the birds themselves can exercise no more voluntary control than they can over the shape of their eggs; for the figure of the egg is nicely and beautifully adapted to the process it has to undergo. It is not a globe, but an oval. This form presents a greater surface to the body of the sitting hen than that of any other known figure, not excepting the perfect sphere. A certain contrivance of design, is it not? Not surely the result of blind chance. Who, then, is the contriver?

It must be quite plain to all persons of experience and intelligence, that it is much more difficult to maintain the heat in a small body than in one of large bulk. A body of small compass has a large proportion of the whole exposed in its surface, and, in consequence, the heat makes its escape with the greater facility. Now the lesser birds act as if they knew this, and accordingly make the surest provision against it; and it has been already shown that the care taken, and the amount and quality of the provision made by the apparently sagacious animals, are in exact proportion to the diminution of the eggs. A gradually increasing necessity is met by a regular and progressive and indispensable quality in the requisite substance. Some good non-conductors of heat are the things wanted, uniting other qualities

at the same time, for they must be soft and yielding, to suit the tender offspring they have to protect.

The birds make choice, then, of just the right materials; as silk, cotton, wool, fur, and down, are among the very worst conductors of heat. So that, let these winged animals range where they will, substances better adapted to their purposes they cannot find. But what can the bird know about the transmission of heat through bodies at all, and in particular, that there are certain properties in some that will permit it to pass freely, while there are others which obstruct its passage altogether? Very few men, indeed, understand it. The science is not known generally, even amongst the most enlightened people of the world. Yet the feathered race have acted as if they have been acquainted with it from the beginning. The faculty, then, which guides them so unerringly to the use of the only means proper to their object, is purely and emphatically instinctive. The operations by animals, as instruments, though neither machines nor automatons, are truly sublime and mysterious. How loudly and sweetly do these creatures of the wing sing, "The hand that made us is divine."

Some birds select a spot for the purpose of building, that if it had been chosen by reason, it would have been easy to discover the motive. Doubtless the object is the same, though the bird seems the only part engaged in the scheme. The following illustrations we quote from Mr. Couch, who has produced an interesting book on the subject: —

"There are few British birds which show more knowledge than the Dipper or Water Ouzel (*Cinclus aquaticus*), in adapting the form and position of the nest to the exigencies of situation; for, in its habits and haunts, it not only differs from the species to which in form it seems most nearly allied (*Turdi*, the Thrushes), but the sites among which it must make its selection compel it to adopt considerable variations, as its favourite mode of escape, when in danger, is dropping into the water, and passing off to a distance beneath its surface. The only spot which could be selected within a given range, in the instance we have under notice, was not so well fitted for concealment as might have been desired; and

therefore its plan was, to mislead an observer, if any prominent part of it struck his attention. The nest was placed upon a stout stone projecting from a promontory which overhung the deepest pool to be found in the course of the brook. And it is to be remarked that though this species is of retired habits, in two instances I have known the nest to be laid at a short distance from a road, along which there was frequent passing of people. The front of the nest rose immediately from the face of the support, in such a manner that anything falling from it must drop into the stream. The material was moss entwined with portions of a living bramble; and to aid the deception, pieces of the stem of a dead bramble had been laid along the top, as if fallen there by accident; but they were so fastened to the structure as to make the whole look like a natural elevation of ground, rising from the overhanging stone to the level of the bank. The nest had no lining, and its bottom was the bare stone, on which the eggs and young rested; and here in this snug successful patch of deception the brood was reared. At the time when it was built, the river was too deep and rapid to make it probable that any one would discover it on that side; and as a combination of deceptive fabric and unsuspected situation, a better instance will rarely be found of the art of thrusting a thing forward to the sight, with the utmost confidence in the choice of arrangement and colour, to secure it from detection.

"Instances of unusual foresight in the mode of constructing a nest, or in the choice of its situation, are related in most books of Natural History, and they might be much multiplied; but the following, taken from *Loudon's Magazine*, and Mr. Yarrel's *History of British Birds*, are sufficient to show how decidedly mind presides over the proceeding:—'The piece of water called Old Pond, about one mile from Godalming, on the London Road, is a most attractive spot to water-fowl; and an island in its centre is the resort of some of them in the breeding season, and also a variety of other birds, which find it a safe and unmolested place for the same purpose. One day, having pushed off from the shore, and moored the little shallop to some of the osiers which surrounded the island, I began my usual examination. The first

object that attracted my attention was a lot of dry rushes, flags, reeds, &c., enough to fill a couple of bushel-baskets. This mass was lodged about twenty feet from the ground in a spruce fir tree, and looked for all the world as if it had been pitched there with a hay-fork. I mounted instantly, thinking of herons, eagles, and a variety of other wonders. Just as my head reached the nest, "flap! flap!" and out came a moor-hen; and dropping to the water, made off in a direct line along the surface, and was soon lost in the rushes of a distant bank. The nest contained seven eggs, warm as a toast. The situation was a very odd one for a moor-hen's nest; but there was a reason for it: the rising of the water in the pond frequently flooded the banks of the island, and, as I had before witnessed, had destroyed several broods by emersion.'"

The Quails afford a remarkable instance of the regularity and strength of the migratory Instinct. They take their flight across the Mediterranean from Africa in the spring, and arrive at a fixed period in prodigious numbers on the coasts of Naples, Sicily, and the Greek islands, where they are then caught and killed by tens of thousands at a time. As many as 100,000 have been taken in one day, and that within a space of three or four miles in extent. The inhabitants of these places prepare for their coming, and await their arrival in expectation of reaping a rich harvest from the flock.

"In Sicily, crowds of all ages and degrees assemble on the shore. The number of boats is even greater, and enviable is the lot of the idle apprentice, who, with a borrowed musket or pistol, no matter how unsafe, has gained possession of the farthest rock, where there is but room for himself and his dog, which he has fed with bread only all the year round, for these delightful days, and which sits in as happy expectation as himself for the arrival of the quails."

A notable illustration of a curious feature of Instinct is to be found in the Sea-Gulls, when in the act of returning from their extensive excursions over the waters of the ocean. These birds are spread throughout all latitudes, residing chiefly on the coast, more particularly about the mouths of large rivers. They wing their way

over the trackless deep with an easy and buoyant flight, exploring the surface of the waters beneath them, by making wide circular sweeps. The gale may blow strong, and the billows roll high, yet these birds will fly over the one, and successfully head the other, as they proceed in search of their food.

Sir Hans Sloane has stated that, at Barbadoes, the sea-gulls fly off in flocks, to a distance of more than 200 miles, and come back again the same day. Now it matters not at all to these voyagers of the sea whether the day be bright or cloudy, or whether the ocean be covered with mist or sunshine, they never lose themselves in either case; on the contrary, they have been observed to take the most direct course homeward, however thick the fog through which they have had to pass. Here we have a feat that no sailor, however long he may have dwelt upon the sea, and however great his practice upon it may have been, can perform; that is, under the same circumstances, without the aid of his compass. Without this useful instrument, any mariner, in the midst of a fog on the ocean, would be lost in five minutes. This small space of time would be sufficient to put him quite at sea. But the gulls have no such aid, yet they take at once the right way, without consultation or inquiry, without hesitation or doubt. The manner of the operation is so odd, that it appears to human reason somewhat in the light of a miracle, and man is at a perfect loss how to comprehend it.

And this leads us to the Carrier Pigeon, the Instinct of which, however, is not more marvellous than that of some others of the kind, and which we have already contemplated. "Who are these that fly as a cloud, and as the doves to their windows?" Originally they came from Persia, which appears to have been, if not of their nativity, the land at least of their settlement. They still fly there in clouds, and obscure the sun by their multitudes. Turkey, Holland, and Belgium are the countries in which they are now most used, the first more especially, but not there so much of late as formerly. For endurance of wing and rapidity of flight, these beautiful pigeons have no species of their order that can equal them. From Babylon to Aleppo, a distance of thirty days' journey, the carrier pigeon has travelled with a

letter in forty-eight hours. The following exploit is taken from Mr. Knight's *Museum of Animated Nature*: —"It is recorded that a gentleman of Cologne, having business to transact in Paris, took with him two carrier pigeons which had young at the time, and on arriving in Paris at ten o'clock in the morning, he tied a letter to each of his pigeons, and despatched them at eleven precisely. One of them arrived in Cologne at five minutes past one o'clock, the other nine minutes later; and consequently they had performed nearly 150 miles in an hour, reckoning their flight to have been in a direct line."

In the notes to Goldsmith the results of two grand trials with carrier pigeons are given thus: "On the 11th of July, 1819, a great experiment was performed with these animals between London and Antwerp. Thirty-two pigeons, with the word Antwerp marked on their wings, and which had been reared in that city, were let loose in London at seven o'clock in the morning, after having their wings countermarked with the name of the British metropolis. The same day, towards noon, one arrived at home, and obtained the first prize; a quarter of an hour after, another arrived, and gained the second prize. The following day twelve others arrived, making fourteen in all. Of the fate of the rest no record has come under our notice.

"In July, 1829, another experiment was made, in consequence of wagers laid at Maestricht between some merchants there, that pigeons taken to London would, when let loose, return in six hours. Forty-two pigeons were brought to London, and after being properly marked, were thrown up at twenty-six minutes past eight in the morning. If any one of the number had arrived at Maestricht within six hours, the principal wager, which was for 10,000 guilders, would have been gained; but in consequence, it was supposed, of a heavy rain, the first did not arrive till six hours and a quarter from the time when it left London, having, nevertheless, travelled at the rate of forty-five miles an hour, assuming that the journey was performed in a straight line. The second arrived in seven hours, the third in seven hours and ten minutes, the fourth in seven hours and a half,

and in four days more than twenty had reached Maestricht."

In such cases the missing birds are supposed to have met with accidents, such as being shot, or to have taken up their abode with other flocks on the road. The moment the carrier is let loose, it wings its way high in the air, in the form of a spiral, widening the circles as it rises, and when finding itself sufficiently far above the earth, it takes the line which points as direct to its destiny and home, as the needle to the magnetic pole. The great peculiarity of these birds is a strong attachment to locality or home. This predilection is necessary to the proper performance of their remarkable exploits; for, unless the desire to return to its native spot was great, it would not probably put its instinctive faculty to the test, in order to find the way back. Hence it is found necessary to train the young birds at first by easy distances, and gradually extending them until a journey of twenty or thirty miles has been made successfully. And when this distance has been once accomplished, it is said that the pigeons which have made it will ever afterwards return from any spot, however remote it may be. It appears, therefore, that practice is necessary to awaken and develop the Instinct.

Some people deny that it is Instinct which guides the carrier pigeon to its home, and ascribe it more to the powers of sight and observation. The latter hypothesis might be received to account for it in short distances, but cannot be admitted to give any explanation in those of such immense length as those instanced. What, for instance, can any bird observe over an extent of two or three hundred miles? It is difficult to believe that the pigeon, or even the eagle, can recognise an object at the distance of twenty miles; but to suppose that either should be able to see any mark much beyond that, is perfectly preposterous. Even if the carrier did really possess such an extraordinary power of vision, it would then be comparatively useless, unless accompanied by a corresponding power of observation. The objects serving as its marks must have been, as it were, previously examined by the pigeon, and impressed upon its senses, before it could turn them to account. Is it, then, to be

supposed, that these birds do really observe so closely, and at the same time so extensively? This cannot be imposed upon our belief.

But why should it not be the result of Instinct? It is not more marvellous in its operation than many other manifestations of the same agent; not more, indeed, than that of the swallow returning to one particular locality in the north of Europe, or to a certain spot in the British Isles, after having come all the way from Africa. The carrier pigeon is guided, doubtless, by Instinct, for nothing else will account for it; and here the mystery must be left, it cannot be explained.

According to the *Assemblée Nationale*, an experiment was made in August last, with some swallows, and the trial came off with success. "Six swallows, taken in their nests at Paris, were conveyed to Vienna, and there let go, with a small roll of paper, containing 1510 words, under the wing of each. They were let go at a quarter after seven in the morning; two arrived at Paris a few minutes before one, one at a quarter past two, one at four o'clock, and the other two did not make their appearance at all."

Instinctive Concert.—Here is another marvellous and mysterious feature of Instinct, and perhaps in no order of animals is it more curiously and interestingly developed than in those of the feathered tribe. The respective families have one plan, and only one; and every individual acts its part as if the mode and time of operating had been severally communicated, and as if all fully comprehended the common object. These things, with man at least, involve a knowledge of the object itself, as well as of the means that will best accomplish it, while he must also be in possession of the medium of communication. But what knowledge has the bird, either of the end or of the means? and what is its language?

In the expedition to the Crimea, Lord Raglan, and Marshal St. Arnaud, Admirals Dundas and Hamelin, knew what they were going about before they set out—the capture of Sebastopol was the object, and each of the chiefs was individually well acquainted with it. The means, too, that were necessary to apply to the task were

pretty well known to them all. So far as their knowledge went, the magnitude, position, and circumstances of the object would determine their adequacy of strength, through the medium of intelligence possessed by the several commanders. But that they should all hit, without any previous concert, upon one plan for putting the operations in effect, is the most unlikely thing in the world. Of course the several projects would fall within certain limits, but no two upon the same line precisely most assuredly, much less all the four. One might see advantages for landing here, a second there; while the third might show reasons for giving the attack upon some particular point, and the fourth upon another. All these certain differences, then, must necessarily be adjusted, the balance of reasons struck, and one course agreed to by the whole conferring party. The several ideas of each could be presented to all the rest, and language was the medium of communicating them. And this again, pre-eminently distinguishes man from the brute, which, if it can communicate at all, can only do so in certain things, even to its own species; while a human being can always employ his language to relate a narrative or to impart ideas to his fellow man.

"What constitutes man," says Lamartine, "is not simply the senses; for the brute beasts have senses like our own, and some of them infinitely more delicate, stronger, and more unerring than ours. What especially constitutes man, is thought; but so long as this thought does not exhibit itself either to us or to others by language, it is as if it were not. Language is not thought, but its necessary and co-ordinate manifestation. So long as a man has not been able to say "I think," he has not thought; he has dreamed; he has possessed instinct, not ideas. There has been intellect, doubtless, but intellect imprisoned and sleeping in the lethargy of the senses, like the fire hidden in the powder, which does not appear until the spark coming near it makes it burst forth to life, light, and liberty. The spark which gives to thought its fire, its light, its liberty, its living power in man and in the human race, is Language: the Word, as it was called by the ancients, who supposed the existence, under the name of this truly divine

faculty, of something intermediate between God and man.

"They were right. Language is the revelation of soul to soul. Who else than God could reveal to the soul his own mysterious creation, this revelation of itself!

"We are, moreover, inclined to think that language was not born of itself on the lips of the primitive man, chattering by accident, and attaching, as centuries rolled on, some vague meaning to inarticulate noises, and giving to others lessons which he had not received himself on the sound, the sequence, and the meaning of these human bleatings. To pass from these bleatings to speech, from speech to the unanimous agreement of words, from the meaning of a few words to the verb and the phrase, from the verb and phrase to logical syntax, from this logical syntax to the language of Moses, of David, of Cicero, of Confucius, and Racine, we must allow to the human race more centuries of existence on this ball of mud than there are stars visible or invisible in the milky way. We must also suppose centuries without number of brutishness, during which the race of man (a being essentially moral and intellectual) must have vainly sought, like the animals, an instance of morality and intelligence, without being able to discover it until after the lapse of numberless generations, without speech, and consequently without intelligence, and without morality. The human race deaf and dumb for a hundred thousand years! I should think it blasphemy to believe in such an incredible mystery.

"I prefer the other alternative, the paternal mystery of the Creator himself, inspiring into the lips of his infant creature, speech, words, language, and that natural expression which affixes to things, at first sight, names appropriate to their form and character. For giving things their real names is in fact creating them anew. Yes, indeed! He must have taught the first word and the first language; He who has made intellect and feeling to be communicated from man to man, the breast to serve as a sounding-board to the tense and trembling strings of our heart, like a musical scale, always complete, which we carry within us; He who made the tongue to articulate, the lips to pronounce, the voice to carry out

the echo of the soul. The wreck of this first and perfect language, decomposed by intellectual decay, must have been remodelled into other various and imperfect languages, as the stones of a ruined temple are slowly built up in the desert to form a shelter for the caravan.

"When language had been given, found, or invented, there were still many centuries to elapse before reaching the other phenomenon, of confining invisible and immaterial thought, in visible and material signs, engraven on a palpable substance. This phenomenon is the art of writing. Writing transfers thought from one sense to another. Speech communicates the thought from the mouth to the ear, through the medium of sound; writing seizes the impalpable sound on its passage, transforms it into forms or letters, and thus communicates thought from the hand to the eyes. The eyes communicate it to the mind, by that ever mysterious relation which exists between our intellect and our senses, and behold speech became palpable, instead of invisible and immaterial as it was before! Is any miracle comparable to this?"

CHAP. XIII.

Reasoning, how produced. — Animal Concert superior to that of Reason. — A Sparrow out-generalled. — Birds, meditating Design. — Swallows, liberating a Captive. — A Scheme from a single Bird. — Curious Conduct of the Partridge. — Crow-Courts. — Punishment of the Criminal. — The Sparrow-Court. — The Lapwing. — Her remarkable Artifice. — The Cuckoo. — Her lacking Propensity. — Selects the right Nest.

Now there can be no reasoning where either intellect or knowledge is absent. The former is the power or the instrument, while the latter may be said to be the material it has to work up. The process is based upon the knowledge of some known facts which have been ascertained to have operated in a certain way, or to have been the results of certain operations that bring forth products according to rule. Observation notes the method; and the proper faculties of man's intellect infer that a similar process, under like circumstances, will produce similar

results. This is called reasoning; and he who recognizes such rule most distinctly, and adheres to it most tenaciouly, is deemed the most profound logician. And animals often act with such a high degree of precision, and with such consummate wisdom, that they appear, in some instances, to be infinitely more skilled in the art of logic than the being whom God has created their intelligent master.

Notwithstanding, animals do not reason. The means of the operation are wanting to them. They have neither intellect, which may be considered the machine, nor knowledge, which may be taken as the working material. That the birds, for example, in their most difficult tasks and nicest workmanship, are quite destitute of any knowledge of the operation or its object, we have the proof in the fact, that a bird of any species, though never having been in company with either of its parents or one of its species, will yet, nevertheless, not only construct its nest without the least deviation from the true model, both as to shape and size, but will also compose it of the very same materials, and place them, too, in the very same order. What on earth can be more remarkable than this? Knowledge, experience, or instruction, then, can have nothing whatever to do with this matter.

But the thing is most striking when one idea is carried out by a number of animals collectively. The question is, how do animals understand one another, so as to work together as if every individual was perfectly acquainted with the design, and that design one? It seems superfluous to ask, do they communicate with one another? when we have just said they have nothing to impart. And since we believe they have no medium of communication, or language, what is therefore the mysterious secret of their concert?

But the feathered tribes supply us with some extraordinary instances of concert. And for once our pen shall range a little beyond the limits of those every-day things we have prescribed to it, so as to let in a little of the unknown and the imaginative; while we will also give somewhat of rein to our credulity, and believe in the general correctness of the statements, at the same time feeling at liberty to reject the showiness of the colours *with which they* have been painted. The following ex-

traordinary circumstance is said to have occurred some years ago on the banks of the Leven, in Fifeshire; and Father Bougeant, the advocate for the existence of brute language, adduces it in favour of his proof.

A sparrow finding a nest that a martin had just built, standing very conveniently for him, possessed himself of it. The martin, seeing the usurper in her house, called for help to expel him. A thousand martins came full speed, and attacked the sparrow; but the latter being covered on every side, and presenting only his large beak at the entrance of the nest, was invulnerable, and made the boldest of them who durst approach him repent of their temerity. After a quarter of an hour's combat, all the martins disappeared. The sparrow thought he had got the better, and the spectators judged that the martins had abandoned their undertaking. Not in the least. They immediately returned to the charge; and each of them having procured a little of that tempered earth with which they make their nests, they all at once fell upon the sparrow, and inclosed him in the nest to perish there, though they could not drive him thence. "Can it be imagined," asks Father Bougeant, "that the martins have been able to hatch and concert this design all of them together without speaking to each other, or without some medium of communication equivalent to language?"

We ask, will Father Bougeant be pleased to tell us which of the martins he imagines concocted the design? For, taking his theory as the correct one, it must surely have originated with one individual, and having language, it was competent to communicate the plan to some others. To say nothing, however, of this communicating medium, which need not be taken into consideration until the competency of a martin to devise the scheme be granted, it is first too much to suppose that any one of these tiny birds had an amount of intelligence anything like commensurate with that displayed by the depth of the design. It is impossible to allow it; for if so, they must be in possession of a very superior reasoning faculty. That the martins did what they are said to have done, we do not dispute; but that it was a purely rational act on their part, we do not for a moment admit. Probably the

proprietor, seeing that she was deprived of her original nest, wished to build another by its side, and the Instinct of self-preservation came into play the instant the necessity for it arose, and the hole was stopped up in order to get rid of a troublesome and quarrelsome neighbour.

Lord Brougham informs us of a singular story, not unlike the foregoing, told by Dupont de Nemours, and which he says he witnessed himself. In this case, swallows performed the stratagem, and Paris was the scene of the exploit. A single swallow had accidentally put its foot into a noose of a cord that was attached to the spout of the pump in the College des Quatre Nations, and the only purpose answered by its own efforts to escape was that of drawing the knot so tight upon itself as to render all further exertions useless. In vain it fluttered till all its strength was exhausted, when it gave utterance to piteous cries, which were sufficiently loud to assemble a vast flock of the same birds upon the spot; indeed, all the swallows from the large basin between the Tuileries and Pont Neuf were soon collected at the post of alarm. For a time, it is said, they crowded together, as if consulting a plan of release. At length the attack being decided on, one of the number commenced the operations by darting at the string, which it struck with its beak as it flew past. Another and another followed in quick succession, till the whole army of besiegers had given a dash at the fort to be dismantled. The combined operation was sustained during half an hour, when the cord was severed, and their captive companion set free. For some time afterwards the whole flock continued to hover together, chattering one among another, as if conscious of a triumph.

Admitting the above to be a fact, and fairly represented, it is so remote from an every-day thing, that it could not be considered very extravagant, nor running wild beyond the range of probabilities, if an explanation was attempted to be sought in simple chance. It is so rare, that it is quite impossible to form an idea how it ought to be put; as one to ten thousand is to bring the chance surely into limits much too narrow, and, perhaps, as one to a hundred thousand may not be sufficiently wide. However, we do not mean to ascribe it to

chance, and thus meet the difficulty, but we cannot allow it to be the result of the swallows' reasoning.

The difficulty is complex, inasmuch as all the individuals of the flock seemed to understand the plan. Let it be supposed that any man of moderate intelligence, or even a genius if you like, stood by as a spectator, and was asked to determine for the swallows the best method of setting their captive comrade at liberty. The great probability is, that he would have said that the task is impracticable for such feeble birds; they cannot do it. It is also very unlikely that he would have devised the expedient which the swallows hit upon, and which they found really practicable. This forbids our belief that the design was formed by the swallows themselves, for we will not allow them an intelligence superior or equal to that with which man is endowed. If the birds, then, had no design, they could have had nothing to communicate.

But let it be supposed that the design really did originate with one bird, what language had that bird to express and make its meaning intelligible to the rest? If the few noises or sounds which animals are capable of uttering be called language, because they can be understood in some limited extent by those of the same species, the term in such cases must represent a very different thing from human speech. The range of the latter, for anything that can be known, is infinite, and its flexibility will admit of every kind of convolution. It is capable of giving expression to any meaning, and to designs that have never before been expressed or conceived. But animal sounds are but conventional signs at most, and these exceedingly limited. They have the note of alarm, and the tone that calls; and these are the two principal points of their speech. Some others they have, but only those that are adapted to the mode of one particular existence, and such as can be understood only by the species. To suppose, then, that animals are capable of giving expression to a totally new invention, to an invention that they have never seen or heard, and which would require not only some varying, but new modes of expression, is monstrously absurd. Yet this is what the martins which blocked

up the sparrow, and the swallows which cut the cord asunder, must have done, if, at least, language was their medium of communication.

We have more than once observed young pigs stray from their sty into those of other families, where they have found themselves the objects of attack; and though they have returned to their own department much bruised and hurt, yet we have never seen a case in which the unfortunate and suffering victims have communicated the affair to the rest of the litter and the mother, both of which have always remained as ignorant and unconcerned as if nothing had been the matter; in short, the one has been as incapable of understanding it as has been the other of making it known. Animals cannot communicate a strange event.

It is perfectly true that animals do seem to communicate things to one another, and that they have certain sounds which are mutually understood is true also; but we apprehend that it is chiefly by Instinct, and not by anything which bears a resemblance to human speech. And the facts we are about to mention furnish the strongest support in favour of the instinctive hypothesis.

On walking across the fields contiguous to game preserves, we have scores of times stepped upon covies of very young partridges, and the moment the old bird has struck the note of alarm, the handsome and pretty little creatures, though in full chirp and active motion at the time, have become as silent as the tomb, and as immovable as a statue. At the mother's warning voice they have dropped coweringly on the ground, as if all had been struck with one and the same stroke of lightning. And thus have they squatted till the parents have returned to indicate the danger was past.

The old birds, too, on these occasions, act in a peculiar and interesting manner. Recourse is had to a very remarkable and masterly stratagem, to allure an intruder from the place of the covey. If reason devises it, the parent partridges play their part with admirable skill. Unlike themselves at any other moment, the two birds, the hen bird more particularly, boldly approach the person who has fallen upon them, doing their utmost, by the means of every possible manœuvre, to attract all his at-

ention upon themselves, that their young may have all he chance of being unobserved. They fearlessly expose heir own life to peril, to save that of their offspring. At first, the old birds will flutter along the ground, sometimes even tumble along, within two or three yards of their disturber's person, and in the direction opposite to the spot on which the covey is sitting. They actually feign the inability to fly, hence they make their movements with drooping wings; while, with no less perfection, they dissemble their power to walk, so they fall to the earth in the disguised attempt to fly away. When the object of their artifice is accomplished, that is, when success has attended their efforts, by the person being misled, they fly off to a distance, and then return to their brood as soon as convenient.

Now, what is this warning note given by the old birds, and received by the young ones? The signal evidently communicates the right meaning, for it is properly understood; and because it is so, it has been called language. If so, it can only be a language that is peculiar to Instinct, and quite unlike the medium of intelligent thought. Human speech or language is acquired, and this distinguishes it from animal conventional signs, which are not acquired. This is quite clear from the fact of their being understood by the young of birds as soon as they are hatched. The young of the partridge supply a most striking illustration. The little creatures may be often seen running about with a portion of the egg-shell still upon their backs, and when danger is at hand, the parent bird gives a peculiar cluck, which is no sooner sounded than every tiny individual of the whole covey yields the most prompt and uniform obedience to it. All understand it at once, and that as perfectly the first time they hear it as they do at the twentieth. Is this, then, acquired? Not in the least. There is no instruction, and there is no experience. Nothing can be more clearly and purely instinctive. And if it is Instinct in the young birds, surely it is not more difficult to believe that it is the same faculty in the old ones.

With regard to the artifice of the old birds, a late writer on the subject seems to think that it is the result

of a mixture of Instinct, skill, and observation; for he says, "Among the remarkable examples in which a combination of Instinct with a skill only to be derived from reasoning, founded on observation, has been shown by animals in the protection of their young, may be reckoned the arts employed by some birds to allure an intruder from the neighbourhood of their nests." Now whether Instinct and Reason give mutual aid, we are not prepared to say. But it does appear to us that the presence of skill, and the power to observe, imply the presence of intelligence, and that the quality or strength of the latter, as the cause, must be in proportion to the displays of the former, as its products.

Let us, therefore, take the case of the partridge as an example, and endeavour to form some sort of estimate of the kind or amount of skill the stratagem of the old bird requires. Such estimate will then be a measure of intelligence, which must, on the intellectual theory, be accorded to these animals of the wing. If the act of the parent partridges in alluring away a stranger be a rational one, then it is contrived with wonderful ingenuity. Not only so, it is even more; for the birds adopt the most likely means possible of answering the end in view. And it must be remarked that human intelligence cannot improve their plan, that is, supposing it to be put into operation to mislead other animals, or even men, who had no previous knowledge or experience of the artifice. The plan is most complete in all its parts; and, under the circumstances named, it is without a defect. The feathered strategists never make a mistake, so as to lead the intruder on to their brood of young; but the opposite direction is always unerringly taken. Their object in approaching so near to the aggressor is evidently to induce him to throw his attack upon themselves; and what can be more tempting to their foes than this? They do more still. They actually tempt the enemy to persevere; and hence their wings are suffered to trail along the ground as if broken; hence also their leaps as if making the effort to fly, but cannot; and finally, their tumbles as if their legs were broken. What man or animal will not these exhibitions tempt to pursue? None.

The temptation is almost irresistible; yet this is the art of a bird.

The power, then, that contrives the plan is a master of all the circumstances; and surely that which operates so infallibly, so as not to be open even to a suggestion from human intelligence, yet possessed by a bird, is a faculty very different from man's intellect. If the design, therefore, is the result of skill and observation, the intelligence of the partridge is superior to human reason; but its being partly skill and observation, and partly Instinct, is a combination we cannot understand. It is just like Instinct in all its particulars, and Instinct we call it. All partridges do it uniformly, and all equally perfect. The bird that has never had a brood of young before, will go through the operation as skilfully as one that has had twenty. This is Instinct with a witness, and we do not see the necessity or the use of bringing in any other power as an explanation to the phenomenon.

Crow and Sparrow-Courts, as they are called, and their business seems to justify the term, supply, in their proceedings, some very curious illustrations of instinctive concert. The laws of their community cannot be broken with impunity; but full justice must be executed upon every delinquent, and the penalty of life be paid for all capital offences. The social principle of the crow is permanent; for, unlike most others, it is continued during the period of incubation; though the assemblies that unite for that purpose, laying claim to certain spots, are but subdivisions of the vast flocks that congregate together to spend the night during the months of winter. Their choice of place is very peculiar, and remarkably uniform. A group of high trees on the margin of a pond of never failing water, and near to some residence, is sure to offer conveniences and special attractions to these cawing and noisy birds. But a common house will not do for them, and this is very remarkable. It involves some secret that has not yet been told. No, they must have either a mansion or a monastery, or one of those old manor structures that have weathered the storms since the age of the Normans or the Romans, and which seem planned and built to last throughout all time. Nothing less than these monuments of the past, or those

representing the greatness of the present, will suit them. On such sites the young are reared, and these are no sooner able to step out of their nests than a force of gunners march to the spot, and bring down the new generation from their stately heights. Notwithstanding this havoc, and though repeated year by year, the same company of rooks will as often return to the place for the like object. It does not drive them from the course along which their proper Instinct leads them.

When the community is formed, the site selected, and the season arrived, the work of building commences with wonderful clamour and bustle. Should there be more than one claimant to any particular fork between the branches, the senior birds, whether conscious of their right to it or not, quickly decide the point of dispute by the force of might; so that from this, and another cause to be mentioned, the scene is full of strife and contention all the time the work lasts. But then there is an end of it. The young rooks, or those of one year old only, often violate the rules of the rookery by pilfering twigs and other materials from the nests of the older ones, but the theft is always discovered, and never suffered to go unpunished. The rogues do not allow themselves to be caught in the actual fact, for they seem to watch their opportunity, and commit their robbery only when both owners are absent.

Now the criminals are convicted in a very singular manner. They first seem to be suspected like a person who has made his fortune too fast to have done it honestly. Having their material close at hand, and already broken up for them, their work goes on apace, and getting so much ahead of the rest, the whole company act as if jealous of such proceedings, and envious of the quick success of their juniors. On these occasions some eight or ten rooks have been seen to fall upon the nest of the convicted, and in a moment tear it all to pieces. The agreement among so many is the curious part of the proceeding. How is the complaint lodged at first? What is the mode of condemnation? What is the medium of that perfect unanimity of action which puts the judgment into execution? To say that all this is the result of reasoning, requires an amount of intelligence that we cannot allow the rook.

But the proceedings of the crow-court have other and more remarkable features. The most regular and notable of these have been observed to take place in the Shetland Isles, among a species of rook termed the *corvus cornix*. According to Dr. Edmondson, a general assembly, composed of deputations from distant quarters, is regularly convened. No business must be transacted till the convocation is complete; the first comers, therefore, wait a day or two for the arrival of the several deputies. A particular field or hill of some character about it is selected, as befitting the importance of the session to be held upon it. When all the deputies have made their appearance, the court opens. What crime has been committed is not known, but criminals there certainly are at the bar. The charges appear to be made, and the evidences given, not individually, but collectively, in a general croaking and clamour; and this seems to include the passing of judgment also, for it is no sooner over than the whole court, "judges, barristers, ushers, audience and all, fall upon the two or three prisoners at the bar, and beat them till they kill them. When this is accomplished, the court breaks up, and quietly disperses."

The first question that presents itself to our curiosity is, how do these birds know when all the deputies have arrived? How are so many informed of the crimes of a few? How are the criminals known? What guard have they? for they seem to make no effort to escape. Are the prisoners themselves conscious of what is about to take place? If so, why not fly off at night, when they could not be pursued? For reason would adopt this course; and if the proceedings of the court were carried on by reason and language, we should feel disposed to allow just as much of both to the criminal as we should to their judges.

The business of the sparrow-court is not gone through with so much formality and rule as that of the rook. A large assembly is not convened. This mode of proceeding appears too tedious for these more off-handed and pugnacious animals. They will have the punishment follow more closely upon the heels of the offence. Here we are reminded of a characteristic of one of the most energetic men we ever knew. When told that the courts of law

were open to him for the punishment of any delinquent, he used to say, "Do not tell me about the law; I want no more law upon him than what I can give him myself." That being over, his magnanimity never allowed him to think more of the offence.

The sparrows act upon nearly the same principle, for when anything is the matter, a force of from four to half a dozen sparrows may sometimes be seen all at once in a cluster, tumbling one over the other down to the ground, and engaged in the sharpest conflict, which is prolonged for a very short time only, but while it does continue the clamour is of the most violent character, and expressive of the most bitter and indignant censure. It is, however, soon over, and the unfortunate sufferer, having endured the penalty, is as well received afterwards by the community as if it had committed no transgression at all. This is generous, and as it should be. Many men would do well to learn this lesson. Man is not always magnanimous, but often manifests a little mind and a mean spirit by cherishing some debasing feelings within his mortal breast.

The Lapwing plays her part to mislead the person in quest of her nest in a manner very similar to that acted by the partridge; with this difference only, that the latter is much less on the wing than the former. Nothing is more difficult than to find the nests of these singular birds. How many times has their art tantalized our ardent desire to satisfy a strong curiosity of youth. In vain have we followed the bird, and in vain gone from her. In vain have we taken the direction of all the cardinal points. In vain have we made the circle, and gone from centre to circumference. It has been even difficult to say whether we have been in the right field or not, for such is the distance this species of plover will lead their pursuers. At length we have grown weary, and after giving up the search in despair, have retired, leaving the bird to return with an air of triumph.

The lapwing, if obliged to quit her nest, does not take wing immediately, but runs to a very long distance, and then rises. All this time, too, she remains very quiet, and it is only when fairly away that she breaks

her silence. The pee-wit then becomes endless, and is given in a tone remarkably plaintive. As she nears and beats about the intruder, her tones get louder, often gliding into a whine or scream, at the same time she is flying round and round, and tossing and tumbling herself in the air. The further she makes from her nest, and appearing to be going on successfully, the more clamorous is her noise, as if she really would, if possible, impress the belief upon the mind of the invader that he was directing his course to the very spot she was so anxious should be avoided; and herein lies the beauty and perfection of her art. But if the nest, on the contrary, be actually approached, the apparently sagacious creature ceases either to make a noise or to manifest concern at all. It is not possible to carry the artifice further; the climax is complete. Human reason, being acquainted with the bird's stratagem, might devise other schemes to mislead men who were in possession of the same knowledge, but none better calculated to allure away an animal, or a human being that was ignorant of the lapwing's practice. The phenomenon is as admirable as it is marvellous.

The Cuckoo is a bird of such singular and exceptional habits that she must come in for some share of our attention and remark. The propensity which makes, with one exception, all others of the feathered tribes the admiration of all observers, is wanting in the cuckoo. It is, therefore, a most extraordinary trait of character. She is apparently indifferent whether her race be perpetuated or not, and the only proof she gives of any concern to have her progeny reared is to be found in the most indirect form. A procreant cradle to receive her eggs she will not only not make, but she will wait neither to provide for her young, nor to protect them.

Being a migratory bird, the cuckoo arrives in England about the middle of April, and takes her departure late in June, or early in July. And here we have a remarkable instance of the infallibility of Instinct as a guide. The young cuckoos, though hatched in a strange nest and brought up by a foster parent, though having never seen an old one of their own species that has gone the way before, will yet migrate at the proper season, and inva-

riably follow in the right direction. The old birds, parents and all, have gone clean off some time before, leaving all the young, which do not depart till the end of August, to find their way as the innate faculty may instruct them, and it is certain a better instructor they could not have. This is a marvellous illustration of the power of pure and unerring Instinct; and this, moreover, in a bird which is said to be the most stupid of winged creatures.

The cuckoo, however, takes one step to secure to her young the means of their subsistence. She leaves them upon the right track. And this must clearly be the result of a peculiar Instinct. The curious device is, to put the young cuckoo in the nests of those birds only which will bring the foundlings their appropriate food. Hence the nests of those insectivorous species which live upon caterpillars, especially the hairy kinds, and various insects, as dragon-flies, &c., are selected by the cuckoo for the reception of her eggs, because such will bring the food upon which her progeny will best thrive.

If the cuckoo had any notion of proportion or dimensions, she would, one would judge, make choice of the nests of the blackbird, or the thrush, as the most fitting receptacles for the size of her young ones; for the nests of the hedge-sparrow, the wagtail, the whitethroat, and titlark, &c., which are those she makes use of, are too small to afford comfortable accommodation to such large birds. Yet the eggs of the cuckoo are very small in comparison to her size, for they scarcely exceed those of the common chaffinch.

But the aliment upon which the blackbird and the thrush usually or occasionally subsist is not proper, perhaps some of it positively injurious to the young of the cuckoo, and this is the main point of the matter; they are, therefore, in spite of their fitness, passed over. And it would seem further, that the cuckoo was really conscious of the inconvenience the small nests she is compelled to adopt will give to her offspring, since she is never known to deposit more than one egg in each nest, as if she was aware that two young birds could not possibly be either properly housed or fed. Her conduct, then, is *shaped* as if she knew all these things exactly; and how

can she know any one of them, much less all? How truly is she guided to the means that will accomplish her end. The phenomenon is remarkably singular and curious. Why this bird should be destitute of the propensity to build her own nest and foster her own young, like others birds, is perhaps yet to be discovered. Doubtless it is an arrangement of an All-wise Providence, and has, therefore, some purpose or other to serve.

When the young cuckoo is hatched before those of its foster parent, it throws the unhatched eggs overboard by means of its broad back, which has, moreover, a depression in the middle, and, therefore, all the more capable of ejecting them. It visits its companions with the same unceremonious treatment, and, suffering no rival, monopolises all the room and all the supplies to itself; for such is the voraciousness of this animal, that the most untiring zeal and labour of the poor hedge-sparrow are scarcely able to satisfy its monstrous cravings. The young foundling, then, appears to act as if it was aware that one party or other must come short, and to adopt, consequently, the lesser of two evils—a prompt starvation instead of a more lingering and cruel death.

The cuckoo is said to possess but weak powers of flight; notwithstanding, they brave and accomplish the journey to this country, nor do they hesitate to make the return. Their young, too, with no parent or bird of any experience to lead them, start off, not as if in search of more genial climes, but in the manner of the sailor who is steering his vessel to a port he has visited times without number, and who is never in doubt as to the line he is taking. The young birds will go; and what is still more wonderful, they will venture upon the waters, though they cannot know that there is land beyond. The impulse is within them, and must be obeyed. Indeed, such is the case with all migratory birds.

"On the 25th of August, 1845," says Mr. Couch, "a late season for vegetation and periodical actions of most natural kinds, a young shrike (*lanius collurio*) was brought to me that had flown on board a fishing-boat in the preceding night, at the distance of four or five miles from land, while apparently in the act of migration, though

its age from the nest was so little that it could be supposed likely to have crossed the Channel ir How marvellously irrepressible the instinct! a admirably correct its tendency.

CHAP. XIV.

Theory of Sensation. — Curious Case of a Swan. — Pigs i Wind. — Galen's celebrated Experiment. — Animal Plants poisonous to them. — The same Plants wholeson others. — Animal Intelligence. — A singular Comba Horses. — Bacon's Raven. — Remarkable Expedient by

THE THEORY OF SENSATION has been put for account for many operations of animals that otherwise considered as instinctive. But we deserves but little attention, seeing how miser the attempts that go to make out any case wha its favour. It is in fact only stumbling from culty to another immediately. Atmospheric doubtless, affect the nervous system of animal as that of man, and produce certain irritations w the springs of many of their motions. And Dr has produced a beautiful poetical illustration of t influence: —

"The hollow winds begin to blow,
The clouds look black, the glass is low,
The soot falls down, the spaniels sleep,
And spiders from the cobwebs creep.

Last night the sun went pale to bed,
The moon in halos hid her head.
The boding shepherd heaves a sigh,
For see, a rainbow spans the sky.

The walls are damp, the ditches smell;
Closed is the pink-eyed pimpernel.
Hark! how the chairs and tables crack;
Old Betty's joints are on the rack.

Loud quack the ducks, the peacocks cry;
The distant hills are looking nigh.
How restless are the snorting swine,
The busy flies disturb the kine.

Low o'er the grass the swallow wings;
The cricket, too, how loud it sings!
Puss, on the hearth, with velvet paws,
Sits smoothing o'er her whisker'd jaws.

Through the clear stream the fishes rise,
And nimbly catch th' incautious flies;
The sheep were seen, at early light,
Cropping the meads with eager bite.

Though June, the air is cold and chill;
The mellow blackbird's voice is still.
The glow-worms, numerous and bright,
Illumed the dewy dell last night;
At dusk the squalid toad was seen,
Hopping, crawling, o'er the green.

The frog has lost his yellow vest,
And in a dingy suit is dress'd.
The leech, disturbed, is newly risen
Quite to the summit of his prison.

The whirling winds the dust obeys,
And in the rapid eddy plays.
My dog, so altered in his taste,
Quits mutton-bones, on grass to feast;
And see yon rooks, how odd their flight,
They imitate the gliding kite;
Or seem precipitate to fall,
As if they felt the piercing ball,
'Twill surely rain."

Man's system, too, is affected by the same changing influences. Some constitutions are so sensitive to the alternating powers, that they have no need of a barometer to indicate the weather that is soon coming, since their nerves supply information as correct as that of the instrument itself. We have known such persons, some of whom have been accustomed to beat about in the air, while others have been given to sedentary habits. Generally they have been of an ailing character, with a bodily frame subject in some parts to infirmity and weakness; and the weakest parts, or those which have obstructions in the circulation, are the parts most affected. On the approach of a change in the weather, a corn, for instance, on the foot of some persons becomes very painful, and sometimes indicates, by the kind of pain induced, what sort of a change is at hand, and how soon it may be expected. In most instances the influence

exerts its power upon the weakest organ of the body, whether that be the head or the chest, or upon any other part that happens to be deficient in strength.

But what is the cause of these aches and pains? Previous to rain the glass sinks; that is, the mercury in it falls lower down, because the air has changed from a certain density to a state of less compactness, therefore will no longer support the semi-metal at the height it stood before the alteration took place. As soon, then, as the change happens, the pressure of the atmosphere on the surface of the human body—the average being fifteen pounds to every square inch—becomes less, and immediately there will be a struggle to restore the equilibrium between the air within the body and that without it. This process, therefore, is probably the cause, in some measure at least, of the uneasiness; and its seat is in the sensitiveness of the nerves.

Then again, as the air becomes lighter, or of less density, a less amount of oxygen, the vital element, is taken into the lungs at every inspiration, wherefore the blood cannot be so perfectly cleansed, for it is the oxygen which is the purifier. Hence many people get drowsy, and sometimes fall into a sound sleep. But this cannot be the only consequence of vitiated blood. It must extend its influence over the whole system, and any imperfection, however small, in the work of the lungs, produces great disorder and much pain in some of the delicate organs of the body.

Another cause is to be sought in the varying electrical states of the atmosphere. And it is quite impossible to say, either what power the presence of this strange fluid exerts, or what are the consequences of its absence. Here we have, then, the operations of three different and distinct agencies, all of which may be considered as having a physical character. We will, therefore, apply these agencies to some instinctive operations, in order to ascertain, if possible, whether they can be made to account for them on the theory of sensation.

"There is a peculiarity," says Mr. Waterton, "in the nidification of the domestic swan, too singular to be passed over without notice. At the time it lays its first *egg*, the nest which it has prepared is of a very moderate

size; but as incubation proceeds, we see it increase vastly in height and breadth. Every soft material, such as pieces of grass and fragments of sedges, are laid hold of by the sitting swan, as they float within her reach, and are added to the nest. This work of accumulation is performed by her during the entire period of incubation, be the weather wet or dry, settled or unsettled; and it is perfectly astonishing to see with what assiduity she plies her work of aggrandisement to a nest already sufficient in strength and size to answer every end. My swans generally form their nest on an island quite above the reach of a flood; and still the sitting bird never appears satisfied with the quantity of materials which are provided for her nest. I once gave her two huge bundles of oaten straw, and she performed her work of apparent supererogation by applying the whole of it to her nest, already very large, and not exposed to destruction, had the weather become ever so rainy."

Mr. Yarrell gives an interesting account of a swan that was about nineteen years old, and having brought up many broods, was highly valued by the neighbours. "She exhibited, some eight or nine years past, one of the most remarkable instances of the powers of Instinct ever recorded. She was sitting on four or five eggs, and was observed to be very busy in collecting weeds, grasses, &c., to raise her nest: a farming-man was ordered to take down half a load of haulm, with which she most industriously raised her nest and the eggs, two feet and a half: that very night there came down a tremendous fall of rain, which flooded all the malt-shops, and did great damage. Man made no preparation, the bird did; and Instinct prevailed over reason. Her eggs were above, and only just above, the water."

A change in the atmosphere, and the cat is disturbed, and she cannot sit quiet. She manifests considerable uneasiness, and begins washing her face to allay the irritation. If the air be overcharged with the electrical fluid, her susceptible hair is the first thing to be affected, and instead of lying down smooth, it becomes ruffled, and probably the sensation of itching is produced on the animal; hence she is perpetually rubbing her coat and ears to smooth down the hair, and wipe off the cause of

the irritation. But being domesticated, puss has no necessity to provide against a fall of rain, or a threatening storm.

In the country, many people may be found who hold the belief that rooks can "smell powder," because they take themselves off rather hastily at the sight of a gun; and by the same force of reasoning, there are as many who come to the conclusion that the pig "can see the wind," because of the squeaking whine, betokening misery, this animal makes whenever a gale is blowing, or is about to rise. It is true that, on these occasions, the more especially when partly exposed in the farm-yard, from want of a water and wind-proof cover, they do often whine most piteously, and sometimes may be seen running about with straw in their mouths, in anticipation of a high wind, the motive of which is, evidently, to collect a sufficient store to protect themselves from the inclement storm. This object, however, they seldom if ever accomplish in the yard; they appear as if they knew the purpose only in part. The straw is carried to no properly defined place, but dropped down anywhere, as if without fixed intention, and as if the plan was not properly matured.

Undoubtedly, it is the impulse of this animal's natural Instinct, which would complete its own work in a state of nature; but the domestic habits of the pig, under man's protection and shelter, have in part destroyed the power to carry out the operations more fully.

These few facts will serve the purpose of our inquiry for an application of the theory, as well as a hundred of the same kind. Let it be supposed, then, that the starting point of the pig's motions has its seat in a sensation which has been produced by a change in the atmosphere, and the facts of the case seem to prove very clearly that the cause is thus in the altered state of that element. But will that account for the operation? How can it? It can do so in no other way than on the supposition that the pig is an intelligent animal, and capable of acquiring sufficient knowledge as to be able to profit by experience.

It is mostly by experience that man becomes acquainted with the signs of the weather, either from his own internal sensations, or from external appearances,

upon both of which he is in the habit of making observations. But can the pig derive any experience in this way? Does it remember that it once felt a particular sensation that was followed by wind or rain, and therefore concludes that the latter was a necessary consequence of the former; and that, on the occurrence of the one, it may very reasonably expect that of the other? This is a process too rational, and involves too much of something like human knowledge to be allowed to the animal; and without it the pig could not know the meaning of any one sensation. We affirm, then, it does not know it, that it cannot judge of the effect from the cause; and that whenever it takes up the straw into its mouth, it is the result purely of its naturally instinctive impulse, an impulse which is clearly and perfectly distinct from the sensation. Sensation, consequently, will not, in our judgment, account for the strange yet proper conduct of these animals. It is only putting the difficulty a little further on.

The same remarks may be applied to the case of the swan, which so admirably provided against the coming flood. That the atmospheric change produced a sensation upon her is quite probable. But the question arises how did she know what it meant, or what was to follow? Only one mode of becoming acquainted with it was open to her, and that was by experience. Then what faculty had she that could collect the circumstances of passing events, and afterwards was competent to work them up as the material for the production of experience? Such a process could not have been gone through without, to some extent, the power of mental abstraction; that is, the ability to conceive, or to form a distinct idea of events independent of the presence of some visible objects that bring into play the powers of association. We know of no case, none most certainly has come under our observation, that affords the least proof that an animal is capable of thinking in this manner. Our belief, therefore, is that the swan knew nothing of the meaning of the atmospheric change by the sensation she might have felt, but that she raised her nest from an impulse that she did not at all understand.

Sensation, as applied to the palate, or to the sense of

smell, may, with much more show of reason, be shown to be a guide to the animal in the selection of its most fitting food. The nerves in the seat of this sense are peculiarly sensitive. Some substances excite upon the palate, or upon the organ of smell, the most disagreeable sensation; while, on the contrary, there are others which gratify it to the utmost. And such a variety does nature supply that she can fill up, with a regular gradation, all the space between the two extremes. To judge what kind of food is suitable to his constitution, man has, in addition to those senses of taste and smell, his intellectual faculties given him, and he is, therefore, not left entirely dependent on the properties of his olfactory nerves and those of his palate. But it is a different matter with the brute. Its intelligence is not sufficient to instruct it in these things. Hence the sense of taste in animals is more adapted for the proper selection of the food especially created for them, and is much more perfect and nice in them than what it is in human beings. On this supposition, animals might naturally be expected, unless under extraordinary circumstances, to give the preference to that sort of food upon which they would thrive best, and to reject that which would be positively injurious to them. And many facts which have been observed and recorded, seem to convert the supposition into a perfect truism.

Perhaps the most remarkable instance on record is that given by Galen, who, after Hippocrates, is considered to have the best claim to the title of prince of the Greek physicians. After his return from his travels, a commotion drove him from Pergamos, where he was born about the year 131; and having repaired to Rome, his eminently successful practice there excited the envy of the faculty, and being then driven from his adopted city also, the land of his nativity again received him, and was honoured with his mortal remains about 200 B.C.

This celebrated philosopher states the case of his remarkable experiment thus:—"On dissecting a goat with young, I found a brisk embryon, and having detached it from the matrix, and snatched it away before it saw its dam, I brought it into a room, where there were many vessels, some filled with wine, others with oil, some with

honey, others with milk or some other liquor, and in others there were grains and fruit. We first observed the young animal get upon its feet and walk; then it shook itself, and afterwards scratched its side with one of its feet; then we saw it smelling to every one of those things that were set in the room, and when it had smelt to them all, it drank up the milk."

The first part of this beautiful story exactly corresponds to the efforts we have often observed in the young of the sheep, and much have we been amused with the manner in which the newly-born lamb has commenced the search for its nourishment. If in a healthy condition, it is very quickly upon its feet. After a little floundering and a tumble or two, it secures a footing, and then begins its peculiar and curious conduct. It does not wait to be taught how to act, or where it must look for the source of its supply; but it goes to work as if that had been already communicated, though it is, perhaps, not ten minutes old. It may sometimes, it is true, be seen beating about the chest of its mother, notwithstanding it puts its head in the right position, and directs its muzzle a little upwards as well as a little forwards. It never makes a search on the ground, but adopts from the first the proper method, and applies itself to the right place. Neither instruction nor experience can have lent it any aid. And perhaps the most remarkable and striking feature of the whole operation is, that the moment its nose comes in contact with the teat of its dam, the little animal instantly seizes it, as if gladly and perfectly conscious it had found the right thing, and with as much apparent certainty as if it had taken it a thousand times before. How admirably and beautifully nice are the operations of Instinct!

"But the great source of instinctive acts," says Bushman, "in the lower animals, are the senses of smell and taste. By these, particularly by the former, they are led with unerring certainty to the selection of their food. Of herbs they reject such as are noxious, while they select those which are salutary, with a certainty which far exceeds the boasted knowledge of man; yet what is this but an original connection between the muscular movement necessary for cropping the herbage and the

sensations which the smell of it excites? How wisely adjusted to each other must be the two processes, and how redolent of inferences of the goodness and greatness of the Creator! but the animal kingdom everywhere abounds with such, and innumerable as they are, they are inadequate to impress us with more than a faint idea of the stupendous extent to which these attributes are displayed. There is scarcely a plant which is not refused by some, while it is eagerly sought after by others. The horse rejects the common water-hemlock, on which the goat luxuriates; the cow refuses the long-leaved water-hemlock, which the sheep is greedy for; and the goat will not touch the wolf's-bane, which the horse enjoys. The Indian buceros devours with avidity the nux vomica, so well known as poisonous to dogs, rats, and most animals; and the land-crab feeds on the berries of the deadly manchineel tree. The deer and the round-horned elk thrive on the broad-leaved kalmia, which is poisonous to sheep, horned cattle, horses, and man. From the flower of the same plant the bee draws honey, and man finds death."

"The bee," says Dr. Hancock, "extracts honey without injury from the flower of this plant," the broad-leaved kalmia, "but the man who partakes of that honey, after it is deposited in the hive-cells, falls a victim to his repast. In the autumn and winter of 1790, at Philadelphia, extensive mortality was occasioned among those who had eaten of the honey collected in the neighbourhood of that city, or had feasted on the common American pheasant, or primated grouse, as we call it. The attention of the American government was excited by the general distress; a minute examination into the cause of mortality ensued; and it was satisfactorily shown that the honey had been chiefly extracted from the flowers of the kalmia latifolia, and that the pheasants which had proved thus poisonous had fed harmlessly on its leaves. The consequence was, that a public proclamation was issued, prohibiting the use of the pheasant as a food for that season."

Animal Intelligence.—That many animals are endowed with some sort of rational property cannot be denied. And this, as we have already indicated, is

spread over the various orders in a proportion remarkably adapted to the necessities of the circumstances of their respective existences, or to the subserviency of the purpose man requires of them. Hence we see it displayed most in those which man finds capable of rendering menial service, but which must be instructed before they can be made manageable and useful. And the competency of their intelligence seems very nicely adapted to receive just that amount of instruction necessary to enable them to understand the meaning of his signs.

Now what is the meaning of this measure of rational capacity? Is it not that the Creator saw in what manner these animals would be useful to the being to whom He had made them subject, and that He, accordingly, provided them with a faculty more flexible than Instinct, and such that would facilitate man's government over them? That this was the object designed by the All-wise, there is not room for a doubt; for we see that the amount of intellectual power given to them is just sufficient to answer that end, and insufficient to perform anything more. This question is of the utmost importance to every philosopher who is devoted to the study of natural history. The prominent import of it may be questioned from the fact that there are other animals besides those which man is accustomed to bring into his special service that have been taught to perform wonderful feats also. But how rarely do we meet with a successful instance! And when it is so, what infinite pains and labour, and discipline and practice, have been bestowed upon it! Here is, therefore, the wide difference. We require no other proof, that the object of so much forced and difficult training in the latter case, then successful only as it were by chance, was not designed by the Being who created them. After all, the instruction which is given to animals, even the highest, is responded to by them, more by a mechanical than by an intellectual method, perhaps much in the same way as a child repeats the multiplication table. But we pass on to notice a few cases that have been taken as proofs of animal reasoning.

"In the spring of 1791," says the author of the article

Instinct, in the *Encyclopædia Britannica*, "a pair of crows made their nest on a tree, of which there are several planted round his garden; and in his morning walks he had often been amused by witnessing furious combats between them and a cat. One morning the battle raged more fiercely than usual, till at last the cat gave way, and took shelter under a hedge, as if to wait a more favourable opportunity of retreating to the house. The crows continued for a short time to make a threatening noise; but perceiving that on the gronnd they could do nothing more than threaten, one of them lifted a stone from the middle of the garden, and perched with it on a tree planted in the hedge, where she sat watching the motions of the enemy of her young. As she crept along under the hedge, the crow accompanied her by flying from branch to branch, and from tree to tree; and when at last puss ventured to quit her hiding-place, the crow, leaving the trees, and hovering over her in the air, let the stone drop from on high on her back. That the crow on this occasion reasoned is self-evident; and it seems to be little less evident that the ideas employed in her reasoning were enlarged beyond those which she had received from her senses. By her senses, she may have perceived, that the shell of a fish is broken by a fall; but could her senses inform her that a cat would be wounded or driven off the field by the fall of a stone? No. From the effect of the one fall preserved in her memory, she must have inferred the other by her power of reasoning."

This singular story is contained in a note to the seventh edition of that work, but our advice would be that it should be given in a supplement to Æsop. It is right to say, however, that the author tells us that the fact was communicated to him "by a gentleman whose veracity is unquestioned, and who, being totally unacquainted with the theories of philosophers, has of course no favourite hypothesis to support." The gentleman's veracity we will not question, but we must beg to be pardoned if we suspect the correctness of his apprehension in regard to the crow's object or motive. That she should watch the cat off is very natural, and she might very possibly drop something from her mouth; but that

she should do it under the motive ascribed to her, and through a process of rather refined reasoning, involves a mode of thinking quite unnatural to her; we think, therefore, that the author's concluding comment is not only misplaced, but that it contributes very largely to the belief that the crow is a positively rational creature.

But why argue from such an isolated fact at all an instance, for aught anybody knows, that has occurred only once in the history of the species? For ten years we lived near the spot where every crow from all the surrounding districts within twelve miles assembled at evening to roost; and over all that period, and among the vast diurnal assemblage which was generally collected in a meadow, we never witnessed any conduct, as being purely the result of reasoning, that required for its solution a fiftieth part of the intelligence that must be necessary to explain the phenomenon of the case we have quoted. Many manifestations of some beautiful Instincts we have seen, but none whatever to induce us to believe that the crow is enough endowed with intellectual powers to reason on the best mode of making her attack. In this particular we differ from the writer we have referred to; but it is with much diffidence that we do so, since the articles which compose that great work, the *Encyclopædia Britannica*, are written, almost without exception, with the rare combination of the greatest talent with the soundest sense.

Lord Bacon, it is said, gives an account of a raven that filled up with pebbles some hollows in a tree containing water, in order to make the liquid rise up to a point within its reach; but whether or not this case came under the personal observation of that remarkable philosopher, we do not know. Lord Brougham, however, brings it under the head of animal intelligence, but with no better reason for it, that we can see, than that of our previous author, when he classes the cat and crow contest after the same manner. We cannot see how an argument can, with any propriety at all, be based upon an extreme and isolated fact,—a fact that almost everybody is just likely to call in question. Let the argument rest upon a broad and visible foundation—upon something intelligible to all.

The same noble and accomplished writer gives the following instance as also illustrative of animal intelligence: — "In the forests of Tartary and of South America, where the wild horse is gregarious, there are herds of 500 or 600, which, being ill-prepared for fighting, or indeed, for any resistance, and knowing that their safety is in flight, when they sleep, appoint one in rotation, who acts as sentinel, while the rest are asleep. If a man approaches, the sentinel walks towards him, as if to reconnoitre, or see whether he may be deterred from coming near; if the man continues, he neighs aloud, and in a peculiar tone, which rouses the herd, and all gallop away, the sentinel bringing up the rear. Nothing can be more judicious or rational than this arrangement, simple as it is."

Perhaps we ought to beg his Lordship's pardon before we venture to say that there is no proof whatever that the arrangement is a rational act at all; unless, however, the result or even the design of the operation be taken as proof, and then too much is proved. The character of the act makes it appear to us much more like the result of instinct than of reason. Now the contrivances of the latter vary, and so much so, that no two men ever design the same thing exactly alike; while, under the same circumstances, the faculty of the former is constantly uniform in its operation; and we are told by Lord Brougham himself, than whom no one perhaps was ever gifted with more multifarious talent, that the same rules are observed by these horses in two different and distant parts of the world — in Tartary in Asia very much to the north of the equator, and in America considerably to the south of that line, and separated, moreover, by a wide ocean on either side.

It is a little remarkable to us that this circumstance did not strike his Lordship when he penned the sentence which ascribes the singular conduct of these animals to reason. If the arrangement was planned by intelligence, we should scarcely expect to find it identically the same in both countries. Their respective native inhabitants will not supply a similar illustration. Would not a traveller think it very strange were he to find himself approached by the sentinel horses of both countries in the

very same manner, then to see them turn away from the very same cause, to neigh in the very same tone; and finally to take up the rear in the very same order likewise? Would he be likely to say that it was the work of two separate intelligences? Could he think the plan had been discovered by the ancestors of these horses at some remote period before the race became divided and scattered to distant regions of the earth, and that all the divisions had taught it to their immediate successors from one generation to another so successfully, even as perfectly as if it had been by stereotype, that it bore the marks of the probability of its being transmitted with every detail, however minute, to the very end of the world? But if not communicated from one to another, then, on the theory of intelligence, every new generation of horses, as well as every individual of the vast herds, must have discovered it for themselves. Then, again, how very singular that the horses in Tartary should hit not only upon the very same plan, but carry it out also in the very same manner, as those in the far off districts of the New World. Is it, then, intelligence? Who will believe with Lord Brougham that it is? We will not most certainly. Our readers will judge for themselves.

The following example as an illustration of the power of reasoning in animals is given by Dr. Hancock: — "Two goats, grazing about the ramparts of Plymouth citadel, got down upon the narrow ledge of the rock, and one of them advancing before the other, till it came to an angle, was enabled to return, but in its way back met its companion, which produced a most perplexing dilemma, as it was impossible for them to get past each other. Many persons saw them without being able to lend any assistance. After a considerable time one of the goats was observed to kneel down with great caution, and crouch as close as could be; which was no sooner done, than the other, with great dexterity, walked over him, and they both returned the way they came in perfect safety. And at Ardinglass, near Glenarm, in Ireland, two goats, moving towards each other, over a precipice 1000 feet high, on a narrow ledge of the rock, were seen to extricate themselves from danger by a similar expedient.

"In both these instances the animals looked at each other for some time, as if they were considering their situation, and deliberating what was best to be done in the emergency. I apprehend that mere Instinct would have prompted them immediately to act, instead of thus comparing and judging, by their outward senses, of danger and expedients."

So writes Dr. Hancock. And the apparent deliberation of the goats may perhaps very fairly be taken as evidence of reasoning; such, however, is its characteristic in man. But is it to be supposed that it operates in animals by an exactly similar method? While, on the other hand, the remarks we have made in favour of Instinct in regard to the wild horses of Tartary and South America, are equally applicable to both the cases of goats before us. The two pairs behaved precisely alike. And nothing can be more indicative of Instinct, and, in our opinion, supports the argument for the instinctive faculty more strongly, than the fact of the animals appearing to contrive a plan of escape gives for that of the intellectual powers. As regards the evidence of the apparent comparing and judging of their situation by the goats, it may be observed, that if taken on the theory of Instinct, both the goats in the two cases would be endowed with the same power; that is, both would have the impulse to drop down, and both the impulse to walk the one over the other. How was this matter to be decided? Which of the two was to drop down? Is this sufficient to give any explanation to the seeming deliberation of the animals?

CHAP. XV.

Instincts of Insects. — The Hive-Bee. — Its Economy and Government. — Its Mathematics a Wonder. — Its Conduct not from Sensation or Reason. — Remarkable Concert. — Repairs an Injury from Accident. — Royal Cells formed by Instinct. — Carder Bees. — Carpenter Bees. — Upholsterer Bees. — Rose-leaf Cutter Bees. — Their wonderful Instinct.

INSTINCTS OF INSECTS. — The instinctive marvels of this class of creation are truly various and many, and

as truly curious and astonishing. Yet there is every reason to believe that but comparatively few of them are known, so that by far the greater number remain hidden from man's view, and beyond the reach of that intellectual search he has hitherto made to discover them. To become thoroughly acquainted with all the habits and instincts of all the orders of the class, would demand the study and devotion of no ordinary lifetime. Their variety is as endless as are their forms, and affords ample scope for the powers of the most intelligent, sagacious, and diligent of men. But who, on earth, is there that can understand all the works of the Most High?

In coming to the insect tribes, we appear to be taking a descending step in the scale of creation, for a definite brain is no longer to be recognised, although the principal ganglion, from the fact of its having its seat in the head of some, is sometimes denominated a brain. The ganglia in insects, distributed over different parts of their body, form about twelve in number, and are connected together by a double cord. The ganglion in the head is double or bi-lobed, and sends nerves to the eyes, to the mouth, and to the antennæ respectively. From the posterior part proceed two delicate recurrent nerves towards the dorsal vessel, which is a long cylindrical tube extending along the back, and though closed on all sides, seems to answer the purpose of a heart; for it is subject to contractions in one part, while the other is being dilated, and in this manner propels backwards and forwards the fluid contained in the canal. The nervous system, then, of the insect tribes is exceedingly diminutive in bulk, and apparently only just sufficient to supply matter for nerves of sensation, and the quantity necessary to connect them together.

Man was to be entrusted with responsible powers, and he was made a thinking being. At the same time he was to be a free agent, that his conduct might be determined and swayed by sufficient motive. He was never designed to give a blind obedience to the laws of his Maker. The motives or the reasons were to be assigned that his obedience might be willing and cheerful, and he was accordingly endowed with intelligent powers that could understand and appreciate them. This thinking

apparatus, or mind, some spiritual thing distinct from matter, was to be united in some mysterious manner with his body; and it pleased the Creator in His wisdom to create some special matter by which it was to perform its functions. This organ of matter is the brain, and is evidently the seat and medium of thought; and in proportion to its health, strength, and vigour, in that proportion does it display the powers of mind. Not that the only difference between a man and an animal is a question of brain; for though the soul of man must be intelligent, it does not follow that all intelligence is spirit. But the Divine Being, never intending to implant an immortal principle in animals, withheld from their physical structure the full and perfect organization of that peculiar matter which appears so essential to the due performance of the functions of thought. And being without responsibility of soul, because they have none, animals are destitute of the means of reasoning, any further at least than is necessary to serve either some purpose of their own existence, or of usefulness to their master. But in the class of beings the wonderful works of which we are about to examine, we find almost as little as possible of brain matter; from which, must it not be naturally inferred, that the All-wise did not purpose that these animals should be thinking creatures? Notwithstanding, it will be seen that many insects adopt principles that, if discovered by man, could only be the result of the most profound reasoning—reasoning, too, that must have been founded upon such depth of mathematical knowledge that not one man perhaps in twenty thousand ever acquires, or is able to acquire. We have, then, to describe some of these animals' habits and works, which illustrate the principles referred to.

The Hive-Bee.— The commonness of this remarkable insect, and man's ignorance, contribute alike their united powers to keep the many marvels of its beautiful policy concealed. And how little do the multitude still know of it! Yet the subject of its economy and government occupied the philosophic genius of Aristotle as well as the muse of Virgil, and we are told that Cicero and Pliny report that Aristomachus devoted a period of sixty years to the study of it. Its beautiful policy, we say; so

it is truly and wonderfully enough, but nevertheless some parts of it are as wonderfully strange and mysterious; still all the different parts are nicely connected together, and dependent upon one another.

The honey-bees are gregarious and social, and the state of their society is well-ordered. Three different kinds of bees compose a society, and this it is which distinguishes them from almost all other insects. There are the drones, or males; the neuters, or workers; and, lastly, the female or queen bee, in which the governing principle of the community resides. She is much longer than any of the others, and is provided with a sting. The drone has a thick body, and an obtuse appearance, but is not so lengthy as the queen, and has no sting. The worker is both shorter and smaller than the drone, its proboscis is extended, and its hinder legs, being transversely striated on the inner side, are particularly adapted for the collecting of materials from flowers. Nearly 20,000 workers are sometimes found in a well-stocked hive, while the drones may not be more than about 700. But there can be but one queen. A rival here is not suffered.

All the labour devolves upon the workers. They engage, moreover, in the profession of arms, as well as in the arts of industry and commercial enterprise. They explore the country for materials to construct the common habitation, collect and bring home all the supplies, attend upon the queen and provide all her wants, defend the hive from the invasion of depredators, and carry on war with all the enemies of the tribe. But the subject of our special attention is their architecture, and that we will now attempt to describe with as much brevity and perspicuity as possible. And for the benefit of those of our readers who may not be particularly conversant with the mode of measuring angles, we offer the accompanying figures, which, from their simplicity, it is hoped, will enable them to understand the method without much difficulty.

All circles are supposed to be divided into 360 equal parts, called degrees, so that the opening between any two lines is measured by these degrees on the circumference of the circle. It will be seen, therefore, that the

angle subtended by the lines *a* and *b* is measured by just a quarter of the circle, *Fig.* 1.; that is, by 90° of it, for

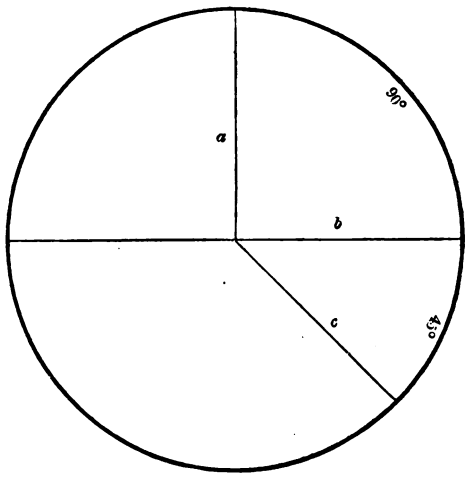

Fig. 1.

this number is a fourth part of 360; but the angle embraced by the lines *b* and *c* is more acute at the corner, and consequently less, measuring only 45°, or only the one-eighth part of the circumference. A much larger or smaller circle may be imagined to be placed over these lines; the measurement of the angles would be still the same, for all the circles, be they large or small, are divided into 360 degrees.

The second example will show that a hexagon, or a figure of six equal sides, cuts the circle in six points, dividing it into six equal parts, each of which must be 60°, since six times 60 make 360. This is sufficient for the present to throw some light upon what is to follow, and we proceed to explain the wonder.

The marvel is in the structure of the honey-comb, which displays the art to such perfection and nicety, that man himself did not only not discover it, but was a long time, and that with infinite pains, before he could

explain it, even when the bee had given him the illustration.

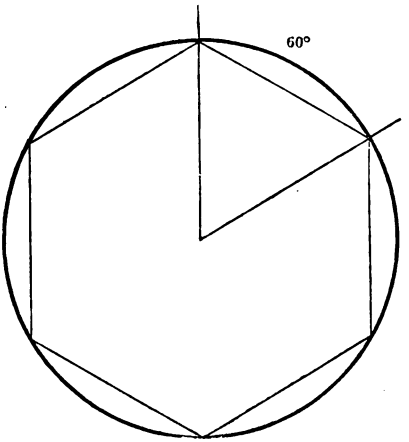

Fig. 2.

The combs are the receptacles for the eggs of the queen bee, and wax is the material with which they are constructed. This wax is secreted by a set of bees that remain in the hive, and which are fed with honey for that purpose by the collectors outside. It is, therefore, a costly article, and when a sufficient quantity is ready the building commences and goes on apace.

The combs consist of a series of plates, suspended from the top of the hive in a vertical position, in the manner of a plate in a plate rack. Let the plate so standing represent the thin partition of wax which forms the bottom of the cells. Then the latter will be constructed on both sides of the partition, in an horizontal or level direction, so that the openings, or the mouths of the cells of one plate, stand opposed to the mouths of that of the next; and in like manner the bottoms are opposed also, and separated only by the vertical partition. Each stratum of combs is about an inch in thickness, and separated the one from the other by an interval of

half an inch, which is left as a space of ingress and egress for the bees going to and from the different cells.

The cells are of an hexagonal form, that is, of six equal sides, about half an inch in depth, and a quarter of an inch in diameter. "The comb," says Lord Brougham, "is constructed thus. Wax-making bees bring a small mass of this material and place it vertically to the plane from which the comb is to hang down. Then other bees begin to excavate, one on one side, another on the other, and they work with such perfect nicety, as never to penetrate through the thin layer of wax; also so equally that the plate is of equal thickness all throughout, its surfaces being parallel."

Now there are only three possible figures, equal and similar, that will allow all the space to be filled up, and admit at the same time of its being divided into compartments. These are the equilateral triangle, the square, and the regular hexagon. No other can be used without leaving interstices; but this would not do, it would not be compatible with the bee's economy of material. A cylinder, though insuring the greatest strength in its form, would, nevertheless, not obtain the balance of advantages in its favour, and the bee, therefore, passes it by. But we beg the reader to pay particular attention to the following fact, and his pains will be well rewarded.

It has been discovered that the proportion of the area of a polygon increases as the number of the sides of the figure; that is, a figure of five sides will give more space or room inside than one of four sides, or a square; and one of seven sides, or a heptagon, more than one of six sides or a hexagon. Now the bee goes to work as if it reasoned in this manner. The square is the most simple figure, and can be constructed without leaving interstices; so far therefore it will suit me; but the principle of an increase of space with that of the number of sides must be taken into the account, and though the next in number, that of five sides or a pentagon, will not admit of all the space being brought into use, a hexagon will; that, therefore, I can take, and being of a greater number of sides than that of a square, it will afford me a greater amount of room.

As to the amount of difference in space between a square and a hexagon, that cannot at any time of course be large; but in the case of the bee's cell, it must be exceedingly small, in a single one scarcely appreciable; yet, in thousands, its total becomes of considerable consequence, and these insects so conduct their operations as if they were perfectly aware of it. How do they know all this? What is it that makes them such clever geometricians? In this science, they have taken the lead, and beat man thoroughly in the race. The marvel is very great; yet another discovery, which we shall next endeavour to explain, puts it higher still.

The vertical plate or thin partition separating the cells, and serving as their bottom, is not a plane; that is, it is not level or flat on either of its sides; but the bottom of each cell is composed of three rhomboidal plates. And that this remarkable contrivance may be quite plain, we have described the accompanying figure, by way of giving it illustration, for it is difficult to understand it without one.

The external six sides represent the bottom of a cell, and the inner lines mark the boundaries of the three rhomboidal plates. The figure of a rhomboid has two

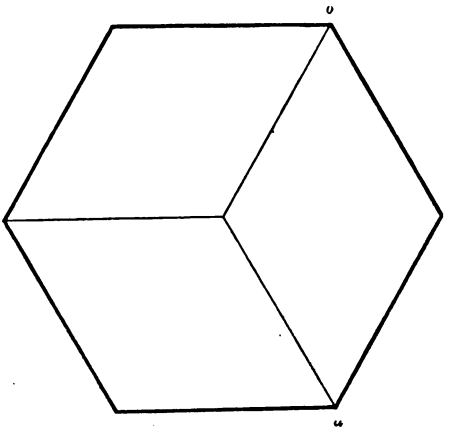

Fig. 3.

of its angles or corners acute, and opposed to each other, as *a*, *b*; the remaining two are also opposed, but they are both obtuse. It will be seen from the figure that the three inner angles of the three plates are all obtuse, and meet in the centre of the cell; but these same three plates do not serve as the bottom of another cell on the other side of the partition plate, for a third part of the three contiguous cells will stand on this bottom, so that the outsides of these three cells will run along the inner lines of our figure, which are, therefore, made to answer the purpose of buttresses, so that greater strength may be given to the whole fabric, for the bottom of each cell rests against the point where three partitions meet. This mode of putting in the bottoms gains all the strength possible, with the least amount of wax. A plane or flat bottom would not serve the purpose so admirably. The contrivance is so beautifully and so delicately nice, that one must pity the mind in which it fails to excite the most touching admiration.

But there is yet another feature about these three plates which is, if possible, more striking and touching than the last. The rhomboidal plates are inclined to one another, that is, they do not lie down level so as to make one flat bottom. Then the question for the bee to determine is, how great the inclination must be, in order to make it most compatible with economy and strength. More like which of these two figures ^ , Λ ? And here, again, it has been found, to the astonishment of the most learned mathematicians, that the insect has determined rightly, for it adopts the precise angle required. This problem "has exercised the skill of several modern mathematicians of great eminence, and has generally been resolved by the assistance of the infinitesimal calculus, or the methods of *maxima* and *minima*."

There are but few men who ever attain the point in the scale of mathematical knowledge necessary to enable them to work out the problem; that is, so as to render them competent to show exactly at what angle the bee ought to make the three rhomboidal plates to meet in the centre. "It would take," says Sidney Smith, "a senior wrangler at Cambridge ten hours a day, for three years together, to know enough mathematics for the

calculation of these problems, with which not only every queen bee, but every undergraduate grub, is acquainted the moment it is born."

The solution of the difficult problem, as to what angle the greatest saving of wax required, gave a result as near as possible to that which the bee actually makes. "It was," says Lord Brougham, "the celebrated Maraldi who first measured the angles, and found them to be 109° 28′ respectively. Reaumur afterwards set a young mathematician, pupil of Bernoulli, called Koenig, to find what were the angles that made the greatest saving of wax, and the result was, by his analysis, 109° 26′ and 70° 34′, being within two minutes of his own measurement, which measurement he had not communicated to Koenig. But it turns out that the bee was right, and the analyst wrong; for, by solving the problem in another way, I find that he erred by two minutes; and other mathematicians, with whom I have communicated, distinctly find the same thing, and we have also found how the error crept in. These angles never vary in any place; and it is scarcely less singular that the breadth of all bees' cells are everywhere precisely the same, the drone or male cells being $\frac{5}{78}$ths, and the worker or female cells $\frac{13}{90}$ths of an inch in breadth, and this in all countries and times."

With respect to the purely instinctive faculty of the bee, Lord Brougham makes some exceedingly appropriate remarks, and couched in terms as forcible as his sentences are lengthened and sustained. "But," he says, "beginning with laying aside those actions of animals which are either ambiguous or are referable properly to reason, and which almost all philosophers allow, show a glimmering of reason; and confining ourselves to what are purely instinctive, as the bee forming a hexagon without knowing what it is, or why she forms it; my proof of this not being reason, but something else, and something not only differing in degree, but in kind, as from a comparison of the facts — an examination of the phenomena in each case, in a word, from induction. I perceive a certain thing done by this insect without any instruction, which we could not do without much instruction. I see her working most accurately without any experience, in

that which we could only be able to do by the expertness gathered from much experience. I see her doing certain things which are manifestly to produce an effect she can know nothing about; for example, making a cell, and furnishing it with carpets and with liquid, fit to hold and to cherish safely a tender grub, she never having seen any grub, and knowing nothing of course about grubs, or that any grub is ever to come, or that any such use, perhaps any use at all, is ever to be made of the work she is about."

Again, when opposing that argument which would make the operations of the results of the gratification of some sense, he, with remarkable appropriateness, says: "A great deal more is done by the bee, and a great deal more must be supposed to make it conceivable that she has any immediate or primary intention. She works so that the rhomboidal plate may have one particular diameter and no other, and always the same length, and that its four angles may be always the same, the opposite ones equal to each other, but each two of different quantity from the other two; and then she inclines the plates at given angles to one another. Why is there such a gratification to the bee in a straight line — in a straight line at right angles to a plane — in rhomboids — in rhomboids with certain angles, any more than in lines or planes inclining at other angles to one another? Why is the bee, after working for half a quarter of a line in one direction, to go on, and not take delight in a change of direction? If she goes on, why is she to be pleased with stopping at one particular point? Nay, why is each bee to take delight in its own little part of the combined operation? Why is each to derive pleasure from doing exactly as much as is wanted, and in the direction wanted, in order that when added to what others have before done, and increased by what others are afterwards to do, a given effect, wholly unknown to her and to all the rest, her coadjutors, may be produced."

The author of the article Instinct, in the *Encylopædia Britannica*, gives also the following admirable paragraph: —"But if the inferior animals on all occasions act with design, we should be glad to know the design of the bees in forming the cells of their combs in the

manner which we have so largely described. Do these little animals indeed know that a comb, consisting on both sides of hexagonal cells, with the bottom of each composed of several planes meeting in a certain solid angle, and so formed as that the bottom of a cell on the one side shall rest upon the partitions between the cells on the other side, is in all respects the most proper both for holding their stores of honey, and for rearing their young? And do they likewise know that its excellence arises from the precise figure and position of the cells, by which there is a considerable saving of labour and materials, whilst the comb at the same time has the greatest possible strength, and the greatest possible capaciousness? If they know all this, and act with a view to these ends, it must indeed be confessed that bees are rational creatures, and that their thinking and reasoning powers far surpass those of men; for they have from the earliest ages made discoveries in the higher mathematics, which there is reason to believe were altogether unknown to the human race till the beginning of the present century, and which at this moment are beyond the comprehension of nine-tenths of mankind in the most enlightened nation on earth."

The concert of the bees, too, is not less entertaining than remarkable, and cannot be better put than in the words of Lord Brougham, whom we cannot refrain from quoting again: — "One bee brings wax, and does not sculpture; another sculptures, and does not bring wax; but the wax-worker brings just as much as the sculpturing bee wants, and at the very time she wants it; also, one works on the face, and another on the back of the same rhomboidal plate; and all so work as never to interfere with or jostle one another, which is the perfection of concert, and can only among men be effected by discipline, which refers the whole of the different purposes to one superintendent, and makes his unity of design the guiding rule and impulse, because concert among the different agents is otherwise unattainable."

Such have been the habits and instincts of the bee from the most remote periods of time, even as they still are from the most remote corners of the earth. The same laws that govern these remarkable communities in Europe

and Africa, are those which the same tribe of animals acknowledge in Asia and America. The bees in China adopt the same figure, with the same dimensions, and form the same angles precisely, as do the same order of beings in England. And well has the poet expressed it: —

> "Thy arts of building from the bee receive;
> Learn of the mole to plough, the worm to weave:
> Learn of the little nautilus to sail,
> Spread the thin oar, and catch the driving gale."

The beautiful edifice, however, though so well contrived, is sometimes, like every thing else in this world, subject to misfortune. Occasionally an accident occurs. Perhaps the material, from the weight of the honey put upon it, gives way, and a stratum of comb becomes detached and falls. And because the little architects have been observed to do the best thing under the circumstances, or to pursue a course that human reason would dictate, in order to rectify the mischief, it has been said, therefore, that they must be reasoning creatures.

When one stratum of the comb has fallen against the side of another resting inclined upon it, the bees have been known to erect some horizontal pillars between the two for the purpose of supporting the detached piece in a certain position until they have fully completed the repair; and that being done, they have then taken away the temporary support altogether as being no longer necessary. This, it is asserted, must be the result of reasoning. That it is just like a rational act, cannot be doubted for a moment; but that it is a rational act on the part of the bees themselves, we ever shall more than doubt. The proof is too much. The reasoning is too refined.

The bee, moreover, is not by any means a sagacious creature when put out of the course of its Instinct. Though, when laden with honey or materials, they may, as it is declared they do, fly home in a line as direct as if it had been marked out by a cannon-ball, yet they have been seen to be confounded and lost by the hive being simply turned a little round while they were out, so as to place the hole to the right or to the left of its usual position. It has seemed as if it were impossible for them to be turned from the true direction. All their efforts

have been made to penetrate the hive in that one particular spot, and in no other. Their behaviour plainly proves that the simple ideas of looking for the entrance elsewhere than at the point to which their Instinct impels them, never occurs to them. Yet such an idea is surely more simple than what is required to repair a shattered comb — to do it at least in the manner it is executed and apparently designed by them.

We cannot think that the method the bee adopts to rectify an accident that may have happened to its honeycomb fabric is more extraordinary, or a greater deviation from the course of its natural instinct, than are some other characteristics of its constructive habits. The royal cells, for instance, seem to us to afford a case in point; and more particularly when one is reared for a special occasion, or to provide against an accident or an emergency. These cells are but few, seldom exceeding a dozen, sometimes only three or four in a hive; and they are not only much larger, but of a different shape — their figure being oblong, resembling a pear. Not only so, there is another very remarkable difference between these cells and the others; and that is in their position, which is vertical instead of horizontal. But the extraordinary circumstance to which we wish specially to advert, is the fact that when the queen bee is lost, and there are no royal larvæ, the workers, after the lapse of four or five hours of confusion and disquietude, proceed to select one of the common larvæ, about three days old, and begin to break down two of the neighbouring cells, destroying the larvæ contained in them, and erecting a royal cell upon their ruins. This cell is worked from the top, which is wide, and is gradually contracted in diameter downwards, until it has reached the bottom, which is narrow. The royal worm is now well fed, and in the space of about ten days she comes forth a queen.

That these are instinctive operations is not denied. But it will be seen that the Instinct which directs the insects on such occasions must be different from that which impels them to build an ordinary cell, and to feed an ordinary grub. Why should they not, then, be provided with an instinct that is competent to guide them in the repair of their edifice, when it has been injured by

an accident that would be likely to happen to it? Did not the Creator foresee this? And has He not, in His wisdom, supplied the bee the means of finding a remedy? This, to us, is a much more satisfactory explanation than we shall ever expect to find in that which is based upon any supposed reasoning powers in the insect itself. Lord Brougham, however, holds to the latter opinion.

"It may be thought," says the writer we have before quoted, from the *Encyclopædia Britannica*, "that a determination of the mind of the brute to act so variously upon different occasions can hardly be conceived without judgment or intelligence. But before our author had so confidently affirmed that such accommodation to circumstances can never take place without a comparison of ideas, and a deduction of inferences, he would have done well to consider how nature acts in other organized bodies, such as the vegetable. We see that a vegetable reared in the corner of a dark cellar will bend itself towards the light which comes in at the window; and if it be made to grow in a flower-pot, with its head downwards, it will turn itself into the natural position of a plant. Can it be supposed that the plant, in either case, does what it does from any judgment that it is best, and not from a necessary determination of its nature? But, further, to take the case of bodies inorganized, how shall we account for the phenomena which chemistry exhibits to us? When one body unites with another, and then, upon a third being presented to it, quits the first, and unites itself with it, shall we suppose that this preference proceeds from any predilection or opinion that it is better to cleave to the one than to the other, from any comparison of ideas or deduction of inferences? Or shall we not rather say, that it proceeds from an original law of nature impressed upon it by that Being who mediately or immediately directs every motion of the minutest atom in the universe? And if so, why may not instinct be an original determination of the mind of the animal, of which it is part of the nature or essence to accommodate itself to certain circumstances, on which depends the preservation of the individual, or the continuation of the kind? Indeed it cannot be otherwise, if we have defined instinct properly; for no man ever supposed,

that when animals work instinctively, they act for no purpose. It is only affirmed that the purpose is not known to them. It is known, however, to the Author of instinct; who knows likewise that the same purpose must in different climates be promoted by different means, and who accordingly determines the operations of animals of the same species to be different under different circumstances."

The bees' policy, with respect to the rearing of the royal brood, and that attention which is bestowed upon their queen, is too remarkable to be passed over in silence; and though we must be brief, it shall have some notice before we dismiss the subject. The royal larvæ come from the same eggs as those of the workers, for only one kind of eggs is laid. But the nursing bees supply, in large quantities, the distinguished family with a peculiar kind of food, which is, moreover, of a better quality, therefore more stimulating, than that given to the larvæ of the common bees. In about five days this rich nutriment and abundant treatment prepares them for the production of their web, which is spun in the course of twenty-four hours. Each of the royal larvæ is now enclosed in its cell by a wall which is built up at the mouth of its palace-prison. It is inactive for two days and a half before it becomes transformed into a pupa, a state in which it remains during four or five days, and then, on the sixteenth day from that on which the egg was laid, it comes forth a perfect insect. The bees gnaw away a part of the wax covering of the cell, in order, as it would seem, to facilitate the exit of the young sovereign. Now this happens about the time a swarm is ready to go off, and the old queen with it; but lest the premature presence of the young queen bee should lead to any inconvenience, she is kept a prisoner by the guards, until the throne has been fully vacated, and her way to it left quite open.

Sometimes a swarm is ready at an unpropitious season of the weather, and the departure of the colony is then delayed. Thus the old queen waits for a favourable state of the atmosphere before she ventures to lead off the new swarm, but in the meantime gives up none of her prerogative, for while confined to the hive she de-

termines to continue the supremacy. And during this delay her successor is kept in close confinement within the walls of her cell, the mouth of which is strengthened by an additional coating of wax, perforated with a small hole, through which she thrusts her trunk for the reception of her food. So jealous is the old queen of her own royal progeny that her resentment becomes quite furious, and were the guards to suffer her to approach their cells, she would instantly give rein to her malignant feelings by transfixing them all with her sting.

The common bees, the subjects of the queen, establish a guard around the royal cells, and if the fury of the reigning monarch impel her to attempt an attack upon them, the sentinels, respecting more the laws of the body politic than the person of their sovereign, beat her off by force as often as she endeavours to come near them; so that even her majesty is not suffered to violate the laws of the community with impunity. But when the swarming is over, and no more queens are wanted, the guards, as if aware of the fact, interpose no further obstacles to the passion of the mother queen, and immediately she tears open every royal cell, and completes the work of destruction by putting every inmate to death. The strange impulse to inflict death upon a rival, takes possession of the young queen also the moment she is liberated from the cell, and, if allowed, she would, after the manner of the old one, put an end to all her royal sisters.

The phenomenon is exceedingly curious, and gives rise to a few questions in the mind of a meditative observer. In the first place, how do the nursing bees know that a better kind of food is necessary to produce the proper growth of a queen? What means have they of knowing what that food is? How do the guards know that it is necessary to protect the royal family from the vengeance of their royal mother? How does she know that they are to be rivals? How does the young queen, that has just come to light, know that she has rivals in her royal sisters? Strange is the secret these questions involve. That the insects do not know the import of their actions is plain; further than this, the questions cannot be answered.

The Carder Bees.—These are a species of humble-bee, but rather smaller than the common one. The peculiarity of their Instinct is to be found in the manner in which they convey the materials for the construction of their nests. A shallow excavation in the ground of about six inches in diameter is selected as the floor of their dwelling. A structure is reared in the form of a dome, composed of grass and withered moss. A file of several bees is formed, and extends from the site of the nest to the spot from which the material is to be gathered. The bee on the extreme end of the file, disengaging the moss and making it up with her fore-limbs into small felted bundles, pushes them one after the other under her body to the next one behind her, and this bee again passes them on to the next, and so the transfer continues until a sufficient amount of material has been amassed at the place appointed for the nest.

The principle is acted upon by bricklayers, when they remove bricks from one place to another by throwing them from man to man, who stand at certain distances from each other. The method is, no doubt, more easy and expeditious than any other; but how do the bees find that out? In what manner do they form themselves into a file? How do they decide which bee is to have the first and which the last place? How is it that there is no confusion among them when taking their places? The bees give a practical answer, but leave the wherefore unillustrated. We call this apparently rational conduct of these irrational creatures the result of Instinct, and that is all that can be said about it. How infinitely varied and exquisitely beautiful are the operations of Instinct—how manifestly do they declare the attributes of its Author!

Carpenter Bees.—Here again we find another and most interesting variety of the Marvels of Instinct. These insects work in wood; hence their title. In the beginning of spring the carpenter bee fixes upon some decayed piece of wood, or upon an old weather-worn post, and commences her excavating labours. By hard dint of boring merely, she sinks a shaft of about twelve or fourteen inches in depth, and of a diameter sufficient to admit a person's finger. Her two strong teeth are the tools

which perform this remarkable feat, and no wonder that it should be a task of several days. The work, too, is finished so smoothly that it needs no lining, nor is any given. During the progress of the excavation, she is careful to remove all the chips which have been chiselled off to a distance. Here is an extraordinary incidental feature of her conduct, and is evidently designed, though not actually by herself, to escape detection. Who teaches her the necessity of the precaution? And what kind of strange impulse is that which obliges her to do it?

The next thing is to contrive the several cells for the prospective young, and that in such a manner that each one may have a separate apartment. A very singular course is taken for this purpose, and which at the same time provides against a serious inconvenience that must happen were it not anticipated and the remedy supplied. The hole being properly bored, the carpenter bee deposits a single egg at the bottom of the shaft, and with it a ball of pollen; and in order to form a separate cell for this egg, she puts down a partition of clay and wood-dust glued together, at a short and proper distance up the tube. Above this partition another egg is laid, and in like manner another cell is formed for it; and so she continues, until the whole tunnel is divided into six or eight compartments, each with its egg and pollen for the unborn grub. The entrance is then well stopped up, blocking all safely in, lest they should become the prey of some devouring enemy.

But how is each weak and tender grub to get out of its casemated prison? The lowermost one, too, will be ready to come out first, and this makes the difficulty still greater. The old bee provides against the contingency, and meets the difficulty. She makes a lateral and horizontal opening at the lower end of the tube, and fills it with saw-dust paste, which, being more soft than the wood, is more easy to penetrate by the tender mandibles of her offspring, and to afford them greater facilities of escape. Through this sort of back door the bottom one can make its way out first, and all the others follow in succession, according to the time of their development. This sort of apparent foresight in the animal strikes man, who is endowed with rational powers and accustomed to reason, as something truly wonderful, and he

pauses with wonder. Then there is another thing that puzzles him with respect to the young themselves, and that is, each grub, on turning into a crysalis, places itself in such a position that its head is turned downwards, as if it was aware that it could not go upwards, so that it then lies in a direction to break open the cell at the lower end, which is the right one.

And not less remarkable is it that the amount of pollen in each cell should be so nicely proportioned to the exact requirement of the grub it has to sustain, for it is neither more nor less than the quantity wanted. How extraordinary and curious is this fact! for the mother herself has no experience of what will be serviceable and necessary, having never before provided for a family, nor having ever known or seen her parents to be taught it by them. Yet she puts in the right kind of food, and all that will be essential for the purpose, and no more. Neither has she ever made a nest before, nor ever seen one made, for she builds but one during the period of her existence, and dies before the next season opens. She goes to work, therefore, not only without a pattern, but without even an idea of it, having never seen one, and without also any previous practice. Let the fact of the enduring uniformity of the plan, and of the manner of putting it into execution, that is, the scheme this bee was made to adopt in the beginning, as well as her method of completing all the parts, which have been continued by the same species unto this day, and ever will be so long as a decayed piece of timber can be found, be taken into reflection, and the reader will have an illustration of the workings of Instinct as beautiful and curious as he ever need wish to revolve in his intelligent and thinking mind.

The *Upholsterer Bees* display in their contrivance another variety of Instinct, though not very dissimilar to the last. One species of them, called the poppy-bee, digs a hole in banks of firm earth or trodden pathways, and, in the shape of a Florence flask, scoops out a chamber to the depth of about three or four inches. This is the cell for the egg, and being situate in the cold earth, and the dirt liable to fall from the sides, has to be provided with a lining, which is an additional feature

to those we have described as belonging to the nest of the carpenter-bee. Some of the upholsterer species make use of the leaves of shrubs for lining their nests, some the petals of flowers, others the down of plants or trees, and our poppy-bee fixes its choice upon the delicate petals of the scarlet poppy for the purpose. Many cornfields produce this plant in greater abundance than is pleasant to the farmer; but notwithstanding the material is so plentiful, the skilful little architect applies it with great care, and adorns her chamber in a remarkably neat and workmanlike manner.

She first cuts the petals into small portions of an oval shape, and carrying them home between her legs, commences the work of lining by spreading very accurately three or four layers of the material over the bottom of her cell. In like manner she proceeds with the sides, covering them with the same scarlet substances quite up to the entrance. The rich colour of the tapestry gives it a brilliant appearance, the beauty of which, however, cannot be supposed to have decided her choice of the poppy leaves. Her next effort is to secure a store of provisions for her young, and having collected a quantity of the pollen of flowers mixed with honey that will fill the cell half an inch up from the bottom, she carefully deposits an egg on the top of the supply. The ends of the scarlet curtains are then folded down so as to embower the egg; thus the little nursery-room is made as conveniently soft and warm for her tender offspring as it is beautifully fine to look upon. But the whole thing must be concealed from a prying and voracious enemy, and the entrance and narrow tunnel are filled up with earth. Her work is now done, and without leaving a watch for the protection of her habitation, or ever thinking any more of it, she retires, and before her young come to light she is numbered with the dead.

Now it is found almost impossible, even upon the most nicely glazed paper, for the human hand to cut out a poppy-leaf, and then lay it down quite smooth; for, in spite of the nicest efforts brought to bear upon this material, it will curl up and wrinkle with great obstinacy. But the little insect we have spoken of knows how to do it well, and, without having learnt, always

performs the difficult art successfully. One would suppose she must have some particular method or art that man, with all his reason, cannot discover; yet she is perfectly acquainted with it almost as soon as she is born. Nor is human intelligence ever likely to find out why this bee should line her nest with the delicate petals of the poppy, in preference to those of any other plant. There is a reason, doubtless; but who can tell what? What particular quality—a quality appropriate to some requirement or other in the young—is there in these leaves that is not to be found in others? Or do they possess a property or poison that some particular invaders dare not touch or grapple with? If so, how should these bees know it? But thus worketh Instinct in mystery.

The *Rose-leaf-cutter-Bee* supplies another example of ingenious habits. She makes a burrow in some solid ground or decayed wood, to the depth of from six to ten inches. The chamber, unlike that of the upholsterer, is horizontal, while its cells are constructed in a very curious manner. They are made and put together in the form of a file of thimbles, the small and closed end of the one being inserted into the large and open mouth of the other in regular succession, and portions of the leaves of the rose-tree form the material with which they are built. Some large pieces of leaf go first to form the lining of the whole tube; but each cell is constructed of ten or twelve circular portions, neatly cut out by the bee's mandibles, and placed in such a manner that the serrated edge of each is always put undermost. And what is truly remarkable, the different layers of leaf are so spread out that no two joinings come together; but the centre of one piece is laid opposite the joining of two others, which gives much greater strength and security to the whole fabric.

The first cell being thus completed, a proper store of honey and pollen is put into it, and then an egg deposited upon the provision, which is obtained chiefly from the flowers of the thistle, and is of a beautiful roseate tint. Some three pieces of leaf, cut out so exactly circular that a pair of compasses would not do it more nicely, are put into the mouth of the first cell, with

the convexity turned downwards, so as to form the bottom of the next one. She repeats this process until the whole series is completed, when the entrance is stopped up, and all is made secure.

This insect's method of cutting out the portions of leaf is extremely interesting in any point of view, but more particularly on account of its perfect inimitability. Clinging to the lower edge of the leaf, she cuts the circumference of the circle with her mandibles, turning as upon a pivot with her feet, which are fixed to one spot. The piece, therefore, she is cutting out, has to support the weight of her body, and when nearly cut round it would tear off, were she to continue to hang by it. Here, then, some contrivance is necessary to guard against the inconvenience of a rent. She seems to be fully aware of this danger, and letting go her hold in time to prevent it, poises herself in the air with her wings, until she has completely detached the piece from the leaf, when she flies off in triumph, either to hang her apartment or build her cell. How extraordinary that this totally inexperienced little creature should throw herself upon the aërial element just at the right nick of time, for she cannot really know that a few fibres only will not support her weight, or that she has weight at all, or that a large surface of the leaf is stronger than a small one. How strange is that impulse, too, which compels her to act as if she was acquainted with all these things. And not a little strange is it also that all this species should hit upon the same plans, and execute them all in the same mode precisely, without a mistake or a deviation in any. How implicitly do all obey the laws of their Instinct. The Almighty hath done this: yet how small a part is it of His many wonderful works!

CHAP. XVI.

Instinct of the solitary Wasp a Marvel. — Of the common Wasp. — Her Mode of rearing a Vespiary. — Her social Policy. — The Wasp and Paper-manufacturers. — Instinct of the Spider very curious. — Her Web a Wonder. — Web of House-Spider. — Ingenuity of Structure. — The Geometric Net. — Tactics of an infirm Spider. — One in a Dilemma. — Trap-door of Mason-Spider. — Her Mode of Defence.

The Solitary Wasps.—INTENSELY interesting are the habits of these insects. The *mason-wasp* chooses a very hard sand or gravelly bank, into which she bores a hole of about three inches in depth, with an entrance that will admit nothing wider than her own body. An egg is deposited at the bottom, and the wants of the offspring are provided for in a manner that displays to us another variety of the marvellous force and precision of Instinct. This wasp collects a number of green caterpillars, and packs one upon another over the egg, in the form of a spiral column, each one in the shape of a ring, and so close and firm that none of them can move, although all still remain alive. Here, then, is the food of the future grub: and what is the quantity it will require by the time it is ready to come from its prison, and to provide for itself? The mother seems to know exactly; for she puts in the proper quantity, neither more nor less than what will be wanted; and the number is generally eleven or twelve, regulated, doubtless, by the size of the caterpillars collected. She closes the mouth of the cell, and proceeds to do likewise in another place.

The old wasp, again, provides for all contingencies in a very remarkable manner; for instance, it is necessary that the caterpillars be kept alive, or they would, as food, become putrid, before the grub would be ready to eat them; she is careful, therefore, to supply only such as are full grown, and on that account can live the

longest time without themselves taking nutriment. Young caterpillars would not retain life long enough to serve the wasp's purpose. But this is not all, there is another feature not less extraordinary, and worthy of special remark: it relates to her method of storing away the living caterpillars. If she were to huddle these worms in a heap, the grub might bite and partake of them severally, and so kill the whole, instead of finishing up one before she commenced another, and this would soon put a period to the grub's own existence, as well as to that of the caterpillars. But the latter being piled one upon another, and the grub at the bottom, clean work must be made as it goes, and thereby it is made to economise the store that has been laid up for it.

But no one will believe that a wasp is endowed with rational powers sufficient to contrive arrangements so appropriate and wise. It is not conceivable that she can know, in any way whatever, either what kind of caterpillars will live long enough to meet the case of her young, or what kind will die before that purpose has been served. Her capacity for knowledge, as well as her powers of discrimination, must fall infinitely short of such as are necessary to distinguish the conditions of the former to maintain life, and the indications of a premature death in the latter. Here is a matter that man himself could not discover without experience. Her Instinct, then, whatever be its impulse, controls her with absolute power, and guides her with unerring precision and wisdom. But how is this mystery? Reader, would you not much like to know this grand secret? Be, then, faithful to Him, who, though not probably in time, but most certainly in eternity, will reveal not only it, but all things else also, to them who yield a willing obedience to His truth. How mighty and sublime must be that intelligence which can receive the light of all His revelations! Who would not participate in it? Independent of the soul's salvation, who can tell how much the wicked will lose?

With regard to this insect, Lord Brougham has so admirably pourtrayed her conduct, and with such happy phrase as well as comparison, that we are again tempted to quote from him:—"Indeed," he says, "I see the

solitary wasp bring a given number of small grubs, and deposit them in a hole which she has made over the egg, just grubs enough to maintain the worm that egg will produce when hatched; and yet this wasp never saw an egg produce a worm, nor ever saw a worm, nay, is to be dead long before the worm can be in existence; and, moreover, she never has in any way tasted or used these grubs, or used the hole she made, except for the prospective benefit of the unknown worm she is never to see. In all these cases, then, the animal works positively without knowledge, and in the dark. She also works without designing anything, and yet she works to a certain defined and important purpose. Lastly, she works to a perfection in her way, and yet she works without any teaching or experience. Now in all this she differs entirely from man, who only works well, perhaps at all, after being taught — who works with knowledge of what he is about — and who works, intending and meaning, and, in a word, designing to do what he accomplishes. The instant a solitary wasp is hatched, or a bee can fly, away they go to the spot where the caterpillars or the wax-yielding substances are to be found. What guides them through the air to things they cannot descry or do not know the use of?"

"If, indeed, you put the case of a person ploughing or sowing for the purpose of strengthening his limbs or amusing himself, and not meaning anything to grow, and also ignorant that anything will grow, and yet choosing the seed which will grow, and sowing it at the right time to make it grow, then you merely put the case of Instinct in other words, and the one thing will be as difficult to explain as the other. And if one man should, by mere blind chance, do this the first time, and some other man, equally ignorant of what the use of thrashed wheat was, should reap and thrash it, and garner it away, and if all men were to do so in two bodies, equally ignorant of what they were about, and yet both chiming in with each other in their operations, and both agreeing with the nature of things, then we should say this is the self-same case with Instinct; but we should add that this could not happen without some overruling power not only giving those men the desire to stretch their limbs, but

guiding them immediately how to do it; for there, as here, two designs and only one designer appears, and therefore some non-apparent contriver exists and works." And again, the working of Instinct is "as if a man were to make a skein of fine lace while he only meant to amuse himself with twirling the bobbins, or playing with his fingers among the flax or threads."

And as to sensation, " it means this: that each desire is so nicely adjusted as to produce in the animal the effects of reason and intention in the same animal when acting with design and knowledge, and not instinctively. The bird is to have a pleasure in bringing sticks or moss to a certain place just at a given time, and putting them in one position; the solitary wasp, in bringing, and only in bringing, for it never tastes, a certain number of caterpillars, and to have no gratification in bringing one more, but the strongest desire, because a sensible pleasure, in bringing the eleventh as much as the first; also no kind of gratification in carrying the eleventh to any other place than the same where all the other ten were put; also a like pleasure in forming the hole for them, without the least regard to the use she is to make of it, nay, ignorant beforehand of its being to have any use; and yet all the pleasure of carrying caterpillars is to consist in carrying them to that particular hole, and there is no gratification to be derived from carrying them to a place one hair's breadth to the right or to the left."

This masterly exposition of the meaning of the theory of sensation, as being the cause of those operations which are performed by animals as if under the control of reason, renders addition and comment quite superfluous. It would be vain to seek a refutation more thorough and complete. The theory of sensation will not account for the operations of Instinct, nor will anything else lying within the regions of human philosophy. All speculative theory upon the subject is vain, so is all philosophising, and a happy and wise man is he who can distinguish between those things which the Creator has determined to keep secret, and those which He has thrown on the paths of intellectual discovery.

The Common Wasp. — Though greatly resembling the honey-bee in its social habits, this wasp yet exhibits

a striking difference, yea, quite a contrast, in its household economy. She is rapacious of the present, but improvident of the future; and the ordinary consequence is brought about by the natural order of events. Neither the queen wasp nor her subjects, which are her own procreant generations, provide any store for the winter; all the summer broods, therefore, with the exception of a few large females which fall into a state of torpidity, perish from the severity of the season. The survivors, in number about ten or twelve out of a vespiary of twenty or thirty thousand, come forth under the influence of a warm breath of genial spring, and quitting their native home, which has now become a loathsome grave of the numberless dead, they roam abroad in solitude, peeping and prying into every hole the mice have burrowed in the banks of the fields, in order to find an aperture that will admit them deep enough to work a chamber in which a new nest may be constructed.

Thus the solitary queen wasp hollows out a chamber of not less than twelves inches in diameter; and this hard and gigantic task, being performed by a single and insignificant insect, may well be considered a prodigy of labour.

The queen first gives a firm lining to the chamber, and then commences the work of building the habitations for her offspring, which are to form the subjects of her populous kingdom yet to come. And here may be asked the interesting question, what is she to do for material? She makes no use of wax, like the bee, but of paper instead, or a sort of papier-maché; and this is of her own manufacture, and not a secretion, as is the wax produced by the more busy insect. She takes some ligneous substances as her raw material, which, by means of her strong mandibles, she tears from decaying trees, weather-worn posts, and soft wood-blocks. The small fibres are bruised as they are torn off, then kneaded and gathered into a bundle with her feet for the convenience of carrying the material home, where it is masticated into a sort of pulp by mixing with it some viscid saliva, which renders it capable of being spread out to the required degree of thinness. The process of this manufacture was one day observed by Reaumur, a female wasp having alighted

upon the sash of his window, and there commenced the operation we have described. A clue was at once obtained to the mode of manufacturing the material of the vespiary. For nearly 5000 years man had gone on making a shift with the leaves of plants, the bark of trees, or the skins of beasts, as his rude writing materials; although the wasp had been acquainted with a better thing, and had shown it to him from the beginning. Strange that this little insect should so long have been the sole manufacturer of such a useful article. But thus did it forestall the art of man. Neither the philosophic Greek, nor the enterprising Roman, ever penetrated her secret, as the annals of their respective countries abundantly testify.

The wasp proceeds to hang her apartments with the paper, not with one covering merely, but with fifteen or sixteen layers, which make the walls of about two inches in thickness; and having spaces left between the several coatings, it presents in appearance a work very much like the shell of an oyster. A floor for the numerous compartments in her nest is hung from the roof by means of pillars of about an inch in length, and the cells, which are hexagonal, are built on to this hanging floor with their mouths downwards. The process of incubation, however, is set going before the whole chamber is filled with tiers of comb, in the manner of the one just described; for after a few hundred cells are finished, the eggs are deposited, and each, to prevent it falling from the bottom of the cell, which is uppermost, is attached with some kind of strong gluten. Presently, then, there is a brood of larvæ to attend to, and the queen wasp must discontinue her efforts of building in order to feed the young grubs, to the pressing wants of which she ministers with very great assiduity, until they assume the pupa state. In a few days a host of labourers come forth, and the moment they can fly, they not only know what is to be done, but how to do it—know what kind of substance it is that will produce the paper—know where to find it—know how to carry it—know how to find their way home with it, though they have never been out before—know how to manufacture the article from the material, and when they have done this,

know how to construct a comb with it; and they perform all these operations as precisely and correctly as if they had all the experience that could be derived from the fabrication of the paper a thousand times over, and with as much expertness of construction as the hand that had practised it a thousand times before. How unaccountably strange does all this seem. That the queen wasp should leave off her work of building to bring forth a brood to her assistance, as if she knew that such was the way to obtain help, is as inexplicable as any part of the whole mystery. It is the introduction of a novelty in our subject, and is another variety of marvel in the power of Instinct.

The first brood being reared, the scene becomes changed, and instead of a solitary wasp and a speck of work, to be seen only at intervals, there is now wonderful life and bustle, and the whole thing goes on apace. Business takes a turn, and a large trade is driving. The queen has brought forth the fruit of her labours, her subjects have appeared, and her reign over her kingdom, already growing mighty and prosperous, commences. The unfinished fabric is continued with rapidity, and there are young in all stages of growth. Thus matters proceed till the end of the summer, when the chamber is often found to contain as many as 16,000 cells, which as often form the nursery of 30,000 wasps. What a prodigious result from a beginning so small and insignificant. Now these hungry creatures go forth to trouble the world with their voracity. There is not much comes amiss to their taste. The shambles of the butcher and the shop of the grocer are both alike unceremoniously entered, plundered, and often very materially robbed of their contents; the bee-hive also is pillaged, while the orchard, the garden, and the vineyard, are all despoiled of their choicest fruits. None of these things, therefore, are at all likely to become putrid and to taint the air, while so many ravenous insects are upon the wing. If, then, they have no other purpose to serve in the economy of nature, this may be an important and useful one.

These insects develop also the policy of the social principle, inasmuch as they make a division of their labour, and appoint, by what method we cannot tell, a

portion of the workers to do the in-door business, while the rest are sent abroad to bring home the necessary supplies. The larvæ obtain the first attention, and when they have been sufficiently fed, the surplus is distributed amongst the home-workers, and apparently with impartiality. Workers, males and females, receive respectively their due share of the disgorged juice. But the business of the season is concluded with a tragedy, contrasting in character as strangely with all the previous parental, tender, and assiduous care over the young, as it does with the object aimed at by all the previous action. It is this: that when the cool October winds begin to intimate the approach of winter, the numerous insects seem as if possessed with a frenzy, and that devoted attachment to their offspring, which has been their characteristic during the months of summer, is succeeded now by a disposition as apparently destructive as the other was kind and cherishing; and with the vengeance of furies do they proceed to put to death all the young inmates of the cells that are not matured enough to help themselves. Were this conduct prescribed by human reason, it would be explicable; but how unaccountable is it as proceeding from these perfectly irrational insects. There being no store of food, the generation now rising must perish, and a violent death, under such circumstances, is accompanied with much less amount of pain than that resulting from a lingering disease, such as starvation would bring about. It is, then, an act, not of cruelty, but of mercy. The wasps perform the deed as if they knew they were doing a kindness to their progeny. Yet they cannot know this. Something, therefore, must impel them to do it: and what is that power? It can be nothing else than the impulse of mysterious Instinct, and that of a somewhat complicated character. And it is all the more remarkable, inasmuch as it is totally opposed to their natural instinctive faculty. Is not this, manifestly, a clear case of a kind of an accommodating power of Instinct? Yea, is it not something more, even?

All the operations of the wasp are so decidedly instinctive, and so admirably adapted to compass the ends in view, that we need not call attention to any in par-

ticular; but perhaps a word more on the manufacture of her paper may be allowed. It is said that one kind of her paper is so excellent, that none of the manufacturers at Maidstone can turn out a superior pattern; and this paper she has been making from time immemorial — from the creation to the times of Aristotle and Pliny — from those ancient sages to the days of Buffon and Cuvier; and she still continues it, and the paper she makes now is of the same quality as that she has been making quite from the first. And more wonderfully remarkable is it that the recent improvements which have been introduced into the manufacture of writing-paper, from the lengthening and the equalising of the fibres, show that the wasp had all along been acquainted with these arts also, and applied them in her process, although man has only so lately discovered them.

The Spider.—This insect, which "is in kings' palaces" as well as in humble cots and forsaken castles, is so common, that it is difficult to impress a mind of not more than average attainment that there is much that is marvellous about it, or anything worthy of close attention. It is, however, a great mistake, although a prevailing notion. If a huge elephant could spin strong ropes from his trunk, and hang them in the form of a net-work across the track of a tiger coming from his lair, and could then be seen placing himself in concealment until he saw his enemy entangled in the meshes, we should have a wonder that everybody would read attentively enough. Yet the ingenuity of the spider to ensnare its prey is on the same principle. And to possess ourselves of the marvels of its Instinct, we shall look into its art of weaving the web, of setting the snare, and its own apparent craftiness while lying in ambush. The success of these combined operations, the skill exhibited in their performance, and the exquisite nicety of their adaptation to reach the end they are destined to do, will, if collectively or individually considered, be of a force sufficient to arouse, even in an illiterate mind, any dormant powers of admiration, though they may have been reposing for a quarter of a century, and that in the midst of a world of wonders.

Though we choose to call the spider here an insect, yet

some naturalists do not, but place the order in the class *Arachnides*, because spiders differ from insects generally, in having no wings, and undergoing no regular transformations from the larva to the perfect insect. Their nervous system, too, is more concentrated than that of insects, being contained in three ganglia only, or swellings of the nervous cords, instead of several, as in the latter class of beings; and on that account the former may be considered as possessing an organised formation that is indicative of a higher order of intellectual power than do insects, which become the prey of the spider. Their brain matter, however, is too small and insignificant either for their boast or their help. The amount is totally incommensurate with the achievements of these insects; for such we shall continue to term them. Their conduct is altogether inexplicable on phrenological principles; nor will it be sought to be compassed by the application of any of the known laws of intelligence. The philosopher has nothing else to apply; he can, therefore, obtain no clue to the operations of that secret power which controls and guides every creature over which it presides in the accomplishing of the purposes allotted to it.

The remarkable apparatus called the spinneret, situated under the abdomen of the spider, merits the first mention; the delicate threads which compose the web are produced by this wonderful spinning machine. It consists of about four cylindrical knobs, a sort of mammillary processes, each of which is perforated by innumerable minute orifices, a thousand and upwards, through which the numberless filaments, from a glutinous fluid that is secreted into reservoirs destined for the purpose, are projected. The spinnerets combined, then, give out upwards of four thousand distinct threads, yet so small as to be invisible; and uniting into one form, instead of a single line, a cord at a little distance from the multitude of nipples, and this cord is the ordinary web of the spider; and in order to present an idea of the imperceptible diminutiveness of the original threads as they issue from the orifices, it has been calculated that a web of a size not larger than that of the human hair would require about 16,000,000,000 of these

simple filaments. This is a marvel great enough for the admiration of a sceptic. But what, then, must be thought of that spinning apparatus, contained in those diminutive spiders that are themselves not equal, in all their bulk, to a single grain of sand? Here we have a marvel in an infinity of littleness. Yet their machines are as perfect as those of the larger species, and operate with as much perfection. He that can realise a definite idea of that portion of a human hair which is but the $\frac{1}{5000}$th part of its whole, may then further attempt to imagine the extent of a single filament of those webs which issue from the spinneret of a small spider.

This machine is under the control of the spider's will, and she can work it or stop it at pleasure. Hence we may sometimes see one of these insects, when drawing out a perpendicular web from the ceiling to which it is attached, come to a sudden halt on her downward course, suspending herself upon the newly-spun cord, often, too, reversing her motion, and, instead of prolonging the web, taking it up again with amazing swiftness. But what she does with it, whether she gathers it up in any particular manner or not, we have not been able to ascertain. Now the spider seems not only to know how, but when and where, to put her spinning apparatus into operation. She stands in the same sort of relation to it as does the engine-driver to his locomotive. She puts on the steam, and starts it; she turns it off, and stops it. She has to determine both the time and the place, which is not a mechanical act at all, any more than that of the railway engine-driver, who turns off, his steam at a given point on the line, in order to bring the train to a stand at a certain station. This is an act of the man's intelligence or judgment, for this faculty decides the point at which the impelling power shall cease to operate, and varies it according to the speed of travel. Something, then, in the spider, either of a mental character itself, or something equivalent to intelligence, is necessary, that she may be able to know when the web is wanted, and what to do for its production. For how otherwise could a young insect, which had never spun a web before, know, when it had found that a trap must be set, that it had the means within itself of

producing just the thing required? And how know also that a snare must be set at all? It cannot be conceived that any satisfactory answer can be made to either of these questions from the intelligence of an inexperienced spider. Yet the apparently knowing creature sets itself to work as if it really understood all the circumstances of both. It puts the machine into operation just when the web is wanted, and not before; and suspends the process of spinning precisely at those intervals that must take place in the course of weaving and constructing net-work, and when the continuance of the product is unnecessary. Though the spider works without either knowledge or experience, yet she performs her task as if she was in possession of the largest amount of both. She does everything at the proper time, and by the most fitting method; and as she works now, she has ever worked, and so she will ever continue. Some invariable laws of certain impulses were impressed upon her constitution at the beginning — laws that were at once perfect in their adaptation to the ends of her being; and being, therefore, unimprovable, are evermore to remain in force, and unchangeable.

To man, the phenomenon is exceedingly strange and curious, because he cannot see how such laws can be made to operate upon the will of animals: still, the fact is stubborn and plain to his perception, and the best and the only thing he can do is to make it the theme of his admiration. The fact that a spider, of a bulk not larger than that of a grain of sand, should yet contain a machine so perfect in all its parts as to be practically workable, is truly a wonder, and something more than an object of admiration merely. It is a display of infinite power in infinite littleness, and may well humble the mightiest men upon earth, as well as those of the highest order of intellectual greatness. Man's idea fails to compass either extreme of the Creator's marvellous works. Magnitudes, on the one hand, and diminution on the other, equally defy the power of his comprehension. In utter amazement, he falls infinitely short in his greatest effort to grasp either the one or the other.

On what principle is the web formed? A rope composed of a number of strings is much stronger than one

of the same size that is spun with a single thread merely. In the formation of the spider's web, then, an eye is had to this principle, though not by the insect nor by her Instinct, but by Him who so organised her constitution that it should produce it, and belongs properly, therefore, to the province of natural theology. The compound web has, moreover, another advantage, and is to be found in its ends, which are divided into several thousand points; and being so divided, the spider's work of fixing it to a support or to the side of a wall is very greatly facilitated.

The common house-spider spreads her net horizontally, and places it in the corners of rooms, or among the rafters of barns and stables. Having fixed the points of the first web, she proceeds to draw it out to an opposite point on the wall, and there fastens it. Now a single web would not be strong enough for the marginal line of the net; and the spider seems to know it, for she takes the proper steps to strengthen it. How curious that she should act thus, as if she either had intelligence in herself, or had profited from experience: hence her judgment that one web was of itself too weak for the purpose; hence also her ability to select the means for a remedy. But she chooses the right, and applies it without hesitation, and therefore without consideration. There is no mistake made, and then that rectified by testing and experience, but she proceeds at once to redouble and strengthen the proper web by adding others to it; just after the manner of an intelligent rope-maker. The young spider, while setting about its first net, works in the same way, and with as much perfection as even the oldest of its species. So, in all probability, do those work also which are, as we have said, not bigger than a grain of sand. What a strange animal must this be that can live and work in the compass of such a mite, and construct an apparatus like an intelligent human being! Where are we to look here for a brain in which the intelligent principle resides and operates? The theory excludes all intellectual faculties from the answers to this question. Then what a wonderful and mysterious power is that Instinct, which prompts and directs the odd actions of this tiny creature!

Having made the points secure and the outer frame-

work strong enough, the insect then draws out her threads in all directions, crossing and recrossing them until her irregular gauze-like structure is completed. Some other lines are run up from its edges, like the tacking of a ship, and form a maze of cordage in order to entangle the rambling flies, and to throw them upon the net which is spread for their destruction underneath. This upper work makes the contrivance more complete. But what teaches the young spider to carry up these additional perpendicular strings, in a manner that seems to give an intimation that the little inexperienced creature was well aware of their object? How subtle the little thing already appears! Nor is this all. She is a foe of grim aspect, and she acts as if she knew it; for she screens herself from the view of her prey by constructing a little silken apartment in some remote corner below the web. Here in her den she patiently lurks until her telegraph line gives notice of a victim on the trap. The electric wires consist of a number of threads carried into her office, and when a fly falls they vibrate, and instantly the artful spider makes a sudden dart along the same lines as by a bridge, and as quickly pounces upon her booty. Now how does she know, without being taught, that it is necessary to conceal herself in a chamber? and her systematic manner of doing it seems to evince her full conviction of the necessity of the artifice.

"Where gloomily retired
The villain spider lives, cunning and fierce,
Mixture abhorred! amid a mangled heap
Of carcasses, in eager watch he sits,
O'erlooking all his waving snares around.
Near the dire cell the dreadless wanderer oft
Passes,—as oft the ruffian shows his front;
The prey at length ensnared, he dreadful darts
With rapid glide along the leaning line;
And fixing in the wretch his cruel fangs,
Strikes backwards grimly pleased; the flutt'ring wing,
And shriller sound, declare extreme distress,
And ask the helping hospitable hand."

"All female spiders," says the writer in the *Encyclopædia Britannica*, "including even the erratic and webless species, are provided with reservoirs of silky matter, which, if not used in spinning, are at all events

employed in forming a protecting covering for the eggs. The most casual observer of nature must have frequently remarked the care with which the anxious mother carries about and watches over her unhatched offspring; and the delicate colour of the silken bag which contains the eggs, and the fine contrast which in some cases it presents to the body of the parent, cannot have escaped observation. The truth is, that spiders, though frequently of a repulsive aspect, are as often distinguished not only by great beauty of colour, but by extreme elegance of form and delicacy of structure. We are prejudiced against the race in general, because all those that dwell within doors are of a dark and lurid hue, and from their haunts and habits, which have become objects of aversion and disgust."

The spider of our hedges and gardens, called the geometric spider, constructs her web more upon a principle than the house-spider, and erects it in a vertical position, instead of spreading it out horizontally like the latter insect. And here again we have another beautiful variety of the instinctive faculty. One position for the hedge, and another for the house; because, undoubtedly, each is best adapted to its uses in its own place. But this must be unknown to either of the species, though they never build any other than the right one. Both adopt the form proper to them, without knowing anything as to their adaptation to the ends to be compassed. The house-spider takes the horizontal direction, without asking why, or knowing why; never building in any other way, and never going wrong. On the other hand, the geometric spider strikes off perpendicularly, ever preserving the same form from one generation to another, as if there was no other way of doing it in the world. There is nothing to invent, because it is not possible to make an improvement. This is quite unlike anything man ever does or ever will do. With all his intelligence, accompanied with all his own experience, and with the advantage of bringing it to bear the knowledge of the past, he has not yet produced an infallible instrument; but he is everlastingly inventing, for there is not to be found one of his works, however ingenious, that can be said to

be brought to such perfection as to be open to no further improvement.

This spider, like the other, strengthens her outlines by glueing five or six webs together, and what has been observed as very remarkable is, that she tests its firmness by pulling it first with her feet; and then, as if she knew how to apply the test in a higher degree, she drops herself down from different points, and swings the weight of her body upon it, in the manner of the motion of a clock's pendulum. The precaution looks like the promptings of memory from a previous misfortune; as if the insect had built once or more the margin of her structure too weak; had been let down, and had her work to do over again; and from such experience she was resolved, for the future, to guard against the repetition of the calamity. Supposing she had been teased in this way, a considerable amount of intelligence would be necessary to enable her to discover the cause of the break down, and to know how and where to apply the remedy. But if a young spider, having no experience of either misfortune or building at all, goes to work in the same way as an old one, then it is conduct so strange that man or his philosophy is at a total loss how to account for it. He can plainly see that intelligence or experience has nothing whatever to do with it; he then says it is Instinct, but what that is he will not presume to say.

The margin or outlines of the figure being manufactured and secured in their places, the spider proceeds next to form the radii, which are the straight lines diverging from the centre to the circumference of a circle, just in the manner of the spokes of a wheel, and as equal in their distances from one another. How the insect measures these distances so as to have them equal we do not know; but this being done, she has been seen to run to the centre, turn herself there quickly round, and to pull each of the radii with her feet, in order to discover if there were any that were not strong enough for the purpose. Those which break by her test are rejected, and new ones spun in their places. It is not a little curious that every one of these insect artificers

should always think to examine its work at the stage now arrived at.

Her next business is to form the concentric circles, from the small one at the centre to the large one on the outer circumference. And the first five or six nearest the centre are run rather close together, while those which follow are about half an inch or more apart. Thus she goes on, round and round the web, until her geometric figure is finished. Nor is it very long about, for the spider is anything but a slow worker; indeed, some parts of the fabric are executed with marvellous rapidity, sometimes so much so, that the eye of an observer can scarcely detect what she is about. But her nicely constructed net is liable to many accidents. It is often rent asunder, or plunged through its midst by an enemy, and then it must be repaired, or, if too much damaged, it is necessary to erect altogether a new one; and should the insect have this to repeat too often, her spinnerets get exhausted of the material; her work is therefore all over, and in order to live, she is compelled to introduce some new tactics. She makes aggression upon the property of a younger spider of the same species; dispossesses the rightful owner, and appropriates the snare to her own purposes, leaving the sufferer, which from its tender age has yet a plentiful supply of gum, to go and construct for itself another net. This is a mode of procedure in the economy of these animals that may appear, at first sight, unfair, cruel, and open to great objection; but if it be remembered that the unfortunate exhausted spider has no other alternative but to perish, and that it costs the young one but little trouble, and not much time to provide for itself another snare, it must be seen that the latter is much the less of two evils, and she is therefore, doubtless, guided to the deed by the force of her Instinct, which may always be trusted to take the right course.

If a spider be put upon a pole or twig surrounded by water, she will be seen to be at no loss how to contrive the method of escape. No sooner does the insect find herself in this dilemma, than a silken line is thrown out at a venture towards some distant object. Such webs are either impelled with a sufficient projectile force to reach an object, or are allowed to float upon a current

of air until they fall upon a support to which they become attached. When finding they are thus firmly secured, the little captive glues the end in hand to the top of the insulated twig upon which she sits perched, and then, after satisfying herself all is right, with no hesitation marches across her suspension bridge in safety and triumph. But before venturing upon it, she does not fail to ascertain whether it can be done without hazard; for she carefully pulls at the lines with her feet, and unless satisfied with the result, she will wait for a better opportunity. What would be thought of an infant only a twelvemonth old that had been cast upon a rock out at sea, and, observing two bladders which the waters had drifted to the same spot, it took them up, and finding there were strings attached to each, proceeded at once to tie them round its waist, the one under the one arm, and the second under the other arm, and then, before risking itself to the deep water, it should experiment upon their safety round the shallows of the rock, and the result being satisfactory, it should immediately launch forth, and, in the manner of a dexterous swimmer, attempt to propel itself to shore! and yet this same child, when rescued, should be like any other child of the same age, and with no more understanding than is commonly possessed at that stage of growth. The conduct of the spider to effect its escape from the insular pole is very similar, and as much of a marvel. The odd manner of working in the one is as mysterious as that in the other. Seeing, therefore, that a young spider will pursue the very same conduct on the pole over water, it would be quite absurd to say that it was the result either of observation from experience, or sagacity from knowledge.

There is, too, a *mason-spider* which displays wonderful ingenuity in the construction of her domicile; and Kirby thus describes the nest and tube of the *cteniza fodiens*: — "The habitations of the species in question are found in an argillaceous kind of red earth, in which they bore tubes about three inches in depth, and ten lines in width. The walls of these tubes are not left just as they are bored, but they are covered with a kind of mortar, sufficiently solid to be easily separated from the mass that surrounds it. If the

tube is divided longitudinally, besides this rough cast, it appears to be covered with a coat of fine mortar, which is as smooth and regular as if a trowel had been passed over it; this coat is very thin, and soft to the touch; but before this adroit workman lays it, she covers the coarser earthy plaster-work with some coarse web, upon which she glues her silken tapestry.

"All this shows that she was directed in her work by a wise master; but the door that closes her apartment is still more remarkable in its structure. If her well was always left open, she would be subject to the intrusion of guests that would not, at all times, be welcome or safe; Providence, therefore, has instructed her to fabricate a very secure trap-door, which closes the mouth of it. To judge of this door by its outward appearance, we should think it was formed of a mass of earth coarsely worked, and covered internally by a solid web; which would appear sufficiently wonderful for an animal that seems to have no special organ for constructing; but if it is divided vertically, it will be found a much more complicated fabric than its outward aspect indicates, for it is formed of more than thirty alternate layers of earth and web, emboxed, as it were, in each other, like a set of weights for small scales.

"If these layers of web are examined, it will be seen that they all terminate in the hinge, so that the greater the volume of the door, the more powerful is the hinge. The frame in which the tube terminates above, and to which the door is adapted, is thick, and it arises from the number of layers of which it consists, and which seem to correspond with those of the door; hence, the formation of the door, the hinge, and the frame, seems to be a simultaneous operation, except that in fabricating the first the animal has to knead the earth, as well as to spin the layers of web. By this admirable arrangement, these parts always correspond with each other, and the strength of the hinge, and the thickness of the frame, will always be proportioned to the weight of the door.

"The more carefully we study the arrangement of these parts, the more perfect does the work appear. If we examine the circular margin of the door, we shall find that it slopes inwards, so that it is not a transverse section

of a cylinder, but of a cone; and on the other side, the frame slopes outwards, so that the door exactly applies to it. By this structure, when the door is closed, the tube is not distinguishable from the rest of the soil; and this appears to be the reason that the door is formed with earth. Besides, by this structure also, the animal can more readily open and shut the door; by its conical shape it is much lighter than it would have been if cylindrical, and so more easily opened; and by its external inequalities, and mixture of web, the spider can more easily lay hold of it with its claws. Whether she enters her tube, or goes out, the door will shut of itself. This was proved by experiment; for though resistance, more or less, was experienced when it was opened, when left to itself it always fell down and closed the aperture. The advantage of this structure to the spider is evident; for whether it darts out upon its prey, or retreats from an enemy, it is not delayed by having to shut its door."

How well worthy of admiration is the design in the whole structure! the completeness of its parts, and the adaptation of one to another, and of all to the end, unite to evince the undeniable art of a master builder. Generally the dwelling is excavated in a sloping bank, and the sagacity of the little creature, which is never at fault, always directs it so that the hinge of the door shall be on the highest side; thus, like a skilful general, taking advantage of the ground position to give greater facility in closing the trap. Why should it not, sometimes at least, for aught the spider knows, get the hinge on the lowest side? But such a mistake is never made, not even by the youngest and totally inexperienced of these insects. Moreover, she leaves a groove or ledge round the top of her tube, so that the trap-door, which is in prospect, may shut into it so fittingly as to make the joining scarcely perceptible; and she does this, too, without any model to guide her, nor, in all probability, has she ever seen one. When cutting the groove, what kind of notion has she about the shape of the lid which is to fit into it, or even of a door at all? She works as if she had determined the plan in her own mind previously, and as if she retained the order of all its parts in her memory. In all such cases, man, through the medium of his mental powers,

obtains an intelligible idea of all the sequences of his work; and even then he requires a pattern.

The facts of the case, then, force us to conclude that this animal has no intellectual faculty competent enough to put her in possession of an idea that the one part she may be cutting must be so shaped as to be adapted to the one that is to follow. Here is the grand puzzle. Human intelligence cannot conceive how it is possible for any being, much less an inferior being, to execute, and that with the nicest accuracy, a mechanical art without having some notion of a plan, or of the work to be performed.

One more apparently intelligent act is done by this spider. It occurs when an attempt is made to pull open her door by an enemy, and is just such conduct that reason would dictate for the purpose of keeping out a foe. The motion of the threads running down the tube warns its inmate of approaching danger, and instantly the spider rushes up to her door, in order to keep possession of the advantage the closed lid gives it. Having seized the silken lining with some of its feet, and the walls with the rest, the artful little defender, turning upon its back, pulls at it with all its might. This mode of defence has its analogy in the common conduct of human beings under similar circumstances.

But, perhaps, more wonderful still, are the habits of the water-spider, or Argroreta. This species constructs an habitation of winter retreat beneath the liquid element. The spider fabricates a chamber in the form of a diving-bell, which she fastens by webs to the leaves of water-plants, and its size is about half that of a pigeon's egg. It is like an oval cocoon, and open at the bottom. Here she sits watching for her prey, and stores up a plentiful supply for the season, and then the bottom is closed. But before doing so, it is necessary that the structure be filled with air, and the little insect performs this duty in a very remarkable and mysterious manner; for, swimming upon her back along the surface of the water, she continues to attach or attract to her abdomen a bubble of air, something like a soap-bubble, which closely adheres to her body as she descends down the stems of plants, and entering the dwelling below, the bubble of air she carries in displaces an equal mass of water; and

she ascends for a second lading, repeating the process until her apartment is filled with the atmospheric element. All is then shut in, and her work is finished.

"How these little animals can envelop their abdomen with an air-bubble, and retain it till they enter their cells, is still one of Nature's mysteries that have not been explained. We cannot help, however, admiring and adoring the wisdom, power, and goodness manifested in this singular provision, enabling an animal that breathes the atmospheric air to fill her house with it under the water, and which has instructed her in a secret art, by which she can clothe part of her body with air, as with a garment, which she can put off when it answers her purpose. This is a kind of attraction and repulsion that mocks all our inquiries." How does she know that air will be necessary? And, what is more surprising, how should she know how to handle such an unmanageable substance as is air?

Here our marvels must be brought to a conclusion, since all the space allotted to them is exhausted, and we have already trespassed too far. To tell all the wonders of Instinct that are to be found in the animal creation, would fill a volume so large and costly, that but few readers would be disposed to peruse, and a still less number induced to purchase. It is, therefore, useless to write what will neither be bought nor read. We only hope that what we have written may be read with interest to the heart, as well as with profit to the understanding, and that none may put it down without feeling that the knowledge of the facts described ought to urge all that are endowed with the powers of reason to see that they fulfil in like manner the mission such powers impose upon them.

CHAP. XVII.

Reason and Instinct. — Reason and Folly. — Creator's Design. — Wisdom. — Man's free Agency. — Reason better than Instinct. — Man's Responsibility. — Animal incapable of Devotion.

By way of conclusion, we ask, first, can anything be said as to instituting a comparison between Reason and Instinct? If, strictly and critically speaking, a comparison cannot be introduced, it can be made between certain aspects of the two powers; but both may be resolved into one power, since, when perfect, they produce the same results precisely. And here is the illustration, that Instinct is Reason put into operation by the Creator; while what we understand by Reason is the same thing, only put into the hands of man, who works it much less perfectly. Reason in man can never become perfect, and its progress towards maturity is only by a slow growth; but Instinct has no progressive stages, for we see that the young kitten acts as warily in the attempt to catch the birds and mice it has the ability to conquer, and the duckling swims and dives after its food as expertly, as their respective and experienced mothers.

A remarkable instance of the instinct of the young alligator is mentioned by Mr. Davy, in his account of Ceylon, where he witnessed the curious phenomenon. Coming across an egg of one of these reptiles, not far from a river, and seeing the egg ready to crack, he broke it open with his stick, and the newly-born animal had no sooner made its escape from the shell than it struck off direct for the stream, as if it had been there many times before, and as if perfectly acquainted with the locality. Mr. Davy then put up his stick before the young reptile, in order to impede its progress to the water, and instantly the pugnacious little creature showed fight, by putting itself in a posture of defence, just after the manner of an old one. Now this was evidently the first time this young inexperienced alligator had found the necessity of resistance, and its action was then as perfect as it ever afterwards could be. The most fitting

attitude of defence was hit upon without having a master to teach it the rules of the art.

Instinct is founded upon Omniscience, while Reason rests upon imperfect, limited, and accidental knowledge; and in the fallen race of Adam it has, moreover, to struggle against the eruptions of Folly, which presents a force totally antagonistic in its tendency. These two rival powers are always contesting the right to sit on the throne of man's intellect, and there are many cases in which their forces so exactly balance, and the number of their triumphs so equal, that it is almost impossible to say which reigns the most; while there are others in which it is easy to distinguish which of the two contending monarchs governs most in the kingdom of intellect. In some, Reason sits supreme, and if she falls at all, or is dethroned, it is only by an accident or a surprise, which forces her to give way for the moment; but it is only for a moment, for the solidity of her rule cannot be demolished by any assault, however furious, that the enemy can make upon it; she soon puts on the armour of her strength, repels the attack, and resumes her sway. But we fear this is a state of things the deeds, the dispositions, and characters of few men only illustrate; and that the lives of the great majority of mankind illustrate the other rule, and permit Folly to reign invariably and undisturbed over their conduct; so that she likewise is only occasionally put off by an accident.

Such will this state of matters continue so long as this world is what it is. Human nature must be entirely transformed by the wisdom that cometh from above, before Folly ceases to usurp the throne of man's heart, and to maintain the greater rule of his life. Ignorance and vice are the two prime ministers of her state, and the principal supporters and promoters of her despotic power. The ignorant and the defiled are equally her slaves, though sometimes with a difference; for the latter often feel the gall of her abominable yoke, while submitting themselves to it, and the dread of that miserable fatality to which they are conscious of being irresistibly hurried in the firm grasp of her iron chains; but the former, since ignorance is bliss, have a more quiet, and a less compunctuous course. Folly reigns in

man's heart by the help of all the vices. Pride, ambition, lust, envy, covetousness, haughtiness, ungovernable temper, are her generals of division; and each contributes its respective share to an inglorious victory, since the person in whom the battle rages is victimised, and, like a town that is sacked by a furious foe, suffers in proportion to the desperation of the strife, and the greatness of the triumph.

It may be asked, what is Folly? What the attributes of her monarchy? What the results of her government? One sentence will express the legitimacy of her functions: it is to make a fool of the man whom she rules. It is to bring upon him, either upon his body or his mind, in one form or another, some unnecessary inconvenience or suffering. Her rule is despotic, and when fully carried out, makes slaves of all her subjects, and fills her kingdom with irremediable ruin and wretchedness. Did ever human being give the reins to pride, ambition, lust, envy, covetousness, haughtiness, and not fall or suffer from their natural consequences? The results follow by an established law of the moral world, nor can the man of mightiest rule avert them. There was a time when Napoleon the Great, "the foremost man of the world," might have made peace with Europe, and have reigned as the greatest monarch the earth ever supported; but he sacrificed to Folly upon the high altar of his ambition, and all the world knows how great was his fall, and how wretchedly were the dregs of his subsequent life wrung out. Such, in a greater or less degree, are all the ends of Folly. But these are results and consequences that form no part of the designs of the Creator; indeed, they are quite opposed to them, for His plans exhibit His benevolence as well as His wisdom. He has impressed laws upon the animal creation, which operate not only wisely, but in a manner so as to be productive of the greatest amount of happiness to His creatures. Hence the manifest pleasure they all take in the execution of the tasks their instincts direct them to accomplish.

But Folly triumphs most when she turns man in opposition to the revealed will of his Maker, and engages him to wage a war with Omnipotence. How vain, how fruitless the struggle! To see a man affect to disbelieve and

to despise the truths of the Bible, is the most pitiable sight upon earth. The argument everywhere overwhelms him, and the power of the Most High crushes him. Let him give attention, and the heavens will testify of the Almighty's awful greatness and glory; the firmament above and the ocean beneath will show the works of Him who divided the one from the other, and set bounds to the swellings of the mighty deep; all the various inhabitants of the fathomless waters, all the fowls of the air, and all living and creeping things upon the face of the earth, from the massy elephant to those tiny existences that people a single drop of water, declare the designs of their Creator; and not one, so far as philosophy has gone, will be found but what will exhibit a principle of construction that is founded upon as much benevolence as of wisdom and power. The perfect obedience that animals yield to the multitude of wise laws impressed upon their constitution, secures to them that enjoyment of life which the Divine Being intended should be theirs; and thus may be read the will of God concerning these tribes of animated being.

And has not the Deity been as provident of man's happiness as that of animals'? If not, why is that world of wonders, the human frame, what it is? Why is it productive of such a vast variety of pleasures instead of so many pains? Why pleasures the rule, and pains the exception? Those of our readers that may be unacquainted with these matters would do well to look into them, and reflect upon the evidences they give. It will then be seen that the Great Author of our being was not unconcerned as to the manner in which even this life was to be spent. And with regard to the life to come, has not He been concerned about that also? Let the Bible be opened; and with that before him, who, looking from Genesis to Revelations, can describe how much is made manifest? The concern of the Father of mercies is plain, and deeper than what man's conception can fathom. Did God require some unreasonable service at his hand, and that for the purpose of making him degraded and miserable in the end, man would then have a show of reason, at least, for his rebellion. In God's government under the Gospel dispensation, there is

nothing repulsive, but everything to induce man to adopt it, and to endear him to it. His rule consists of love, which animates with delight, and not like the spirit of despotism, which paralyses with fear. The Most High will not have His servants to be slaves, like the serfs of a despot. His service is perfect freedom, which has ever been realised and appreciated in the strongest manner by the most eminent of Christians. And who can speak upon this point with so much authority as those who, after having spent a long period in the service of sin, tasting every sweet and pleasure she had to offer, have been arrested by God's grace and converted to the faith of His Son? Stronger testimony than this cannot be had, and wise and happy is the man who receives it and acts upon it.

Even the Christian, however, may not always be wise with respect to the things of time, but he is most assuredly pre-eminently so for eternity. And what is this mortal when put against the immortal? Nevertheless, the All-wise has designed that man's conduct should always be controlled by Wisdom, and He has accordingly provided him with the means of obtaining wisdom, which is a legitimate product of the powers of Reason. Wisdom is the making the best use of knowledge and power. If judgment is the comparison of ideas, and the comparison of judgments Reason, then Wisdom consists in putting that result into practice. It therefore follows that the degree of Wisdom must depend in some manner upon the extent of knowledge and the efficiency of the reasoning faculty; or, in other words, that the most consummate Wisdom must be accompanied by the most perfect and unlimited knowledge. These two things are brought together in the instinctive faculty of animals. And the thing itself is wielded by the Divine hand itself. The animal has no power in either—has neither will nor choice in the matter. And here it must be observed that the Creator has intrusted to man a faculty that He has not committed to the animal. What does this prove, but that man was intended to be the nobler, the more important, and the superior being?

Man has the power to do as he pleases with regard to the adoption or rejection of many courses; while the

animal, though having a pleasure in what it does, has no such liberty of action. Man is intended to be acquainted both with the motive and the object of all his operations; but the animal lives and works without any knowledge of either. Man is endowed with faculties that render him capable of collecting the facts of history, which furnish him with experience and material for reflection on the past, and the same endowments enable him to contemplate the future; but the animal does not know that any past has been, or that there will be any future. Man is in no way, or never designed to be, a mechanical agent; and when he is so, it is either by accident, or by the debasing spirit of despotism.

With respect to the relationship between himself and his Maker, man is designed to be as much of a free agent as possible. God's rule is not despotic. The laws of his government are such that, if obeyed, will secure to his creatures the greatest possible happiness, and preserve them from degradation and misery; but He does not coerce the obedience. The Divine Being has given him intelligence that he may judge for himself, and having done that, He then leaves him to a voluntary choice. What can be said to this by those narrow-minded, but widely bigoted people, who affect to believe that there are certain classes among men that ought not to be allowed to exercise an opinion, neither on the matters of this world, nor on those of the next? What say the priests and Pope of Rome to this?

When we see men without brains, like animals, we will then believe they are the people that should not be allowed an opinion, but not before. We therefore venture to say, that when one man takes upon himself to suppress by his influence the thoughts and opinions of another, he assumes to himself an unwarrantable and undue authority, and one that God himself does not exercise. And when this is done in religious matters, the assumption is as wicked as it is monstrous. Where the Creator has given a mind, he has intended that it should be made use of.

We gather, then, from all these considerations, as well as from many others unmentioned, that the Almighty has designed that man should occupy a position in the eco-

nomy of His grand Creation, infinitely more noble and exalted than that destined to be filled by those tribes which He governs by Instinct. Of the infinity of objects of desire or attainment which God has placed within man's reach, none are given to him without the motive for seeking them. The motive is, too, of that kind which sustains at once the pleasure and the perseverance in the process. His intelligence puts him in possession of the power to balance the past and the future on the present. In addition to the pleasures imparted by the actual operations of the present, to which Instinct confines the animal, it is a peculiarity of intellectual faculty to be able to extract a pleasure from the reflection on the events of the past, and also from the anticipation on the probabilities of the future. Of course we now refer to intelligence unabused. This excellent and superior gift puts man, therefore, in a very curious and interesting relationship with the past, the present, and the future; and when properly used, ministers to him the pleasures peculiar to all the three. But the animal is totally ignorant of the past, blind as to the future, and sensible only of the present.

Intelligence, again, is capable of deriving pleasure from infinite sources, and of infinite variety; while Instinct limits the animal to pleasures to one kind merely. Intelligence appreciates and delights in beauty—in the beauties of form and colour—in proportion and symmetry. Place it in the midst of some beautiful and picturesque scenery, or some magnificent prospect, teeming with nature's best variety and greatest grandeur of rugged mountain and fruitful valley; or present it with a view of a flower's delicate ground-work, decorated with those rich and golden tints which the art of the florist displays with so much taste, variety, and perfection; or let it be conducted to the precincts of the Falls of Niagara, as an exhibition of nature's majesty, and to those of the Pyramids of Egypt, as relics and monuments of the past; or let the bowels of the earth be opened, to show it the course of the untold ages that was required to lay the foundations of the world; or accompany it into the laboratory, and ask the chemist to illustrate the discoveries *of nature's* marvellous minglings; or throw open the

world's library, and allow it to revel among the treasures of the richest lore; or lay before it some nicely executed plans of the best styles of architecture, and ask its choice; or give it an excursion to Parson's Town, in order to survey the barren rocks, and deep and dry clefts of the moon; or put it in possession of the means of measuring the startling magnitude of the sun; or acquaint it with the law of gravitation which discovers the weight of Jupiter; or put on all the powers of the telescope, that it may penetrate the immeasurable and inconceivable depths of space, and then say even that is but a portion of immensity, and that the far-off worlds that can be descried are comparatively but few; — and in all these things, as well as in thousands of others that might be named, what power can describe the glowing and transporting inspirations each and all would engender in the God-like faculty? How intense the many, of what thrilling interest the whole!

But who ever saw an animal, under an instinctive impulse or an intelligent motive, gazing upon the bow in the clouds, imagining to itself the beauty of the picture, and manifestly delighting in the view? Let, for instance, two kennels be built, the one of the finest porcelain, like the Nankin tower, and in the best and most attractive style of the architect, and the other in a loose and careless form, and with the material of a mud hut; and then give a dog, the most intelligent of animals, the choice of the two dwellings, and it would be seen that he would pay his respects to that which had the best inside conveniences, without having the least regard to the handsomeness of the structure. Neither the dog, nor the horse, nor the elephant, the most sagacious of animals, was ever cheered by a splendid prospect of natural scenery, or ever put into a state of admiration from the effects of its beauty. Nature would have been ornamented and decorated in vain, and in vain would have been all her nice symmetries and fine proportions, had there been no beings but animals to look upon them.

The power to discover is another attribute of Intelligence, while Instinct has nothing to invent whatever. *This, too,* is a source of the most exquisite pleasure *to the agent* of intellect. The falling of that apple,

which threw a light upon the principle which keeps the Universe in order, must have been a source of so much satisfaction to the philosopher, that he could not have grudged it the labours of a lifetime. Even a boy, who has been puzzled by a rule of arithmetic, thinks exceedingly light of the difficulty, after he has once found out for himself the nature of the operation, inasmuch as he can appreciate his own discovery. So it is also with regard to the acquisition of knowledge, which is the mission of intelligence; and the pleasure derived from it is always in proportion to the labour bestowed upon it. What rightly enlightened person would choose again to be ignorant? The devout and cultivated mind feels that it is its great gain to go on, since there is enough in the Almighty's vast and grand Creation to occupy any intellect, however expanded it is destined to become, through an unknown duration; but the animal knows nothing of such pleasures. Is, then, Instinct better than Reason? We hesitate not to say, emphatically, No.

Man, therefore, whom the Divine Being has entrusted with the best gift, to do with it as he may think proper, is responsible for the right use of it. The ends of Reason and Instinct are or should be the same; and as Wisdom is the great attribute of the one, so also should it be of the other. And the abuse of Reason is Folly. The Wisdom of Instinct teaches man the object of his Reason; and the liberty of his will, or his free agency, teaches him his responsibility; and Revelation, and the consciousness of his own immortality, teach him that he is to be wise for eternity, as well as for time,—that he is responsible for his soul, as well as for his body.

Finally, Instinct is destitute of any devotional impulse, while with human intelligence it is universal, and unmistakeable. Every barbarian, and every savage, is endowed with an instinctive consciousness that there is a Supreme Being somewhere, and that he is bound to do Him reverence in some form or other; and from the same faculty he is capable of worshipping the Unknown. Reason discovers the ways of that Being, and the Gospel makes Him known. But the animal, guided by Instinct, or a glimmering of Reason, is totally incapable of devotion, and cannot, therefore, worship. No man, how-

ever stoical, can enter the quiet chamber of death,—whether that be solemn from gloomy despair, or peaceful from the strength of faith,—and remain unaffected, or retire without some reflection upon the momentousness of the scene he had witnessed; but were a dog to enter the same abode, though he might discern that there was something unusual, or even manifest some uneasiness, he would yet be unimpressed with any sense of awe, and would go away without a reflection; nor can the least idea of God be imparted to an animal of any class or order. It can be done, neither by instruction, nor experience, nor language, nor signs. Nor does Instinct impress it. All the means that can be devised are and ever will be inefficient, all powerless for the purpose; it is an impossible task. Yet in man it is the instinctive idea, the first and ever prevailing one; it is the foundation of man's devotion and worship. God himself has laid it, and left man to build up the structure upon it, so as to make in his body a temple of the Holy Ghost. Here, then, we have the great distinguishing feature between man and the brute, and unmistakeably marked and plain. And he who will not look at this beacon, to receive its admonition, must expect to flounder and wreck upon the quicksands of his own folly.

Summary.—If we have rightly apprehended the nature of Instinct, so far at least as it is not inscrutable, the views we take of it are such as are embodied in the following summary; and since some of them stand opposed to the conclusions which many higher authorities have drawn from it, and through them been put into a sort of stereotype form, it is with much hesitation that we endorse our own opinions, and almost with mistrust that we present them. A diversity, however, of view, of opinion, and of sentiment, is not an unmixed evil, inasmuch as such a quality of the human mind brings out *truth in greater* purity than it otherwise would do, were *man's reasoning* and noblest faculty but a blank uni-

formity. It is not, therefore, desirable that all people should be of one mind upon everything; it *is* desirable though that all mankind should agree to differ, where a difference is inevitable, from its being a very law of mental constitution, and desirable upon no subject more than upon that which unites the creature to the Creator, and which He wills should unite all people in one grand principle of brotherhood. How little and narrow in conception is that mind, how unlovely that heart, which cannot tolerate a difference without a disagreeableness, or a suspicion, or a hatred! Let us, then, not be afraid of a little variety, but give the freest scope to the canvass of all opinions, that truth may come out in greater force and beauty. And our interpretation of Reason and Instinct stands thus: —

Firstly. That the Deity, in governing by Instinct, does so through a mysterious and mediate law, and not by His immediate superintendence.

Secondly. That brain is the only medium of mind, and that its matter, subject to the conditions we have named, is a pretty fair measure of intellectual capacity; thus giving an index of mental ability as correct as physiognomy does that of moral character.

This matter, composing the brain and nervous system, unlike any other physical organisation, possesses some very peculiar qualities, to wit, that remarkable property of being susceptible of pain; and where it is not present through a nerve, or where dissevered from the brain itself, there no sensation of suffering can be produced.

Thirdly. That this curious structure is complete in man, but defective in animals.

Fourthly. That, as regard animals, the brain is most developed in those of the most intelligence.

Fifthly. That the largest amount of brain is given to those animals which are brought, and which were designed to be brought into man's special employ.

Sixthly. That Instinct, with the solitary exception of the beaver, opens with greater purity in birds than in mammals, and purest of all in Insects.

Seventhly. That sensation is no cause of instinctive operations, and will in no way account for them.

Eighthly. That Instinct is accompanied with a sort of

latent power, designed to meet those accidents or emergencies only to which its work is liable.

Ninthly. That Instinct is the perfection or the essence of Reason, or Reason put forth in fullest maturity.

Tenthly. That Reason, as given to man, is superior and more exalted than Instinct, which is given to govern the animal.

In reference to the fourth summary, we may remark, that here something was wanted that would be more flexible and accommodating than Instinct, and accordingly these animals were endowed, if we may so express it, with a dark shade of the intellectual faculty, which should be capable of receiving instruction within some defined limits, or only so far as it should have relation to some particular department of service. As, for instance, the horse can be educated as a beast of draught or burden; but we presume there would be some considerable difficulty in training him to act the part of a shepherd's dog among sheep. Imagine the shepherd asking a horse to neigh for the bark of his dog, and to run from front to rear of his flock, and the very idea appears ridiculous; it violates all our received notions of propriety. Should any one be doubtful as to this matter, just let him try the experiment, and we will venture to say that he would not be soliciting a second task for a long time to come.

The intellectual endowment of the brute is, therefore, not merely defective and qualified, but it is also greatly circumscribed in its operations.

Seeing, then, that those animals only which are adapted to serve man's immediate purposes are sufficiently intelligent to benefit by instruction, and that within very narrow and uniform limits, what, we ask, is the significance of the adaptation? Does it open to us any pathway by which we can approach the meaning of the Deity? If so, it throws a great light upon our road, for we may rest assured that whatever the Divine *intention* was, so, to all intents and purposes, the thing *really is.* His design was not surely that the animal

should reason, or the power would not have been so defective and circumscribed. We see that there is just enough intelligence given for the animal to understand all the signs necessary to facilitate man's government over it, and not enough, as we take it, to produce the ability to reason. It serves all the purposes of the former, but gives several plain indications that the animal was not destined for the latter.

Furthermore, if it be allowed that animals do really reason, where are we to stop, and where are the limits? for we have never yet been able to discover how an animal can be admitted to reason on one thing without its being able to do so on others, especially on such as are not more difficult or complicated. This surely cannot be granted.

Then, again, what would be the consequence if even only the more intelligent animals reasoned? What, under ill-treatment, might not the horse be expected to do, either in harness, in the stable, in the yard, or in the meadow? What would he sometimes think about his short commons? He might, on some occasions, very justly reason that his master was his enemy, instead of being his friend and protector. Would he also suffer so much as he does? Would he forbear so long as he does? As much or more might be said of the dog, and of many others as well as he, were it at all necessary, and we did not feel it incumbent to desist from prosecuting the subject at greater length.

Once more, the human intellectual machinery may be compared to that of a watch with mainspring, click, and ratchet, all complete. The mainspring sets and keeps the whole train of works in motion; and that singular faculty which enables man to think in an abstract manner, that is, that faculty which has the power to call anything to mind without seeing it, or hearing it, or feeling it, or anything else that is or ever has been connected with the thing to be brought up, as previously explained —may be called the mainspring of man's mind. Now without going into resemblances of mere fancy, it may be stated, that the mind of the animal is entirely destitute of this faculty or mainspring of thought, the power by *which it can* abstract itself *in* thought. The few and

imperfect wheels it has in its machinery must be turned by the power of accidental association, which, in results, bears a resemblance to the fitful and irregular motion that would be produced were the works of a watch kept going by the capricious hand of its manufacturer, instead of that uniform and steady action which is applied by the tension of the mainspring.

THE END.

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